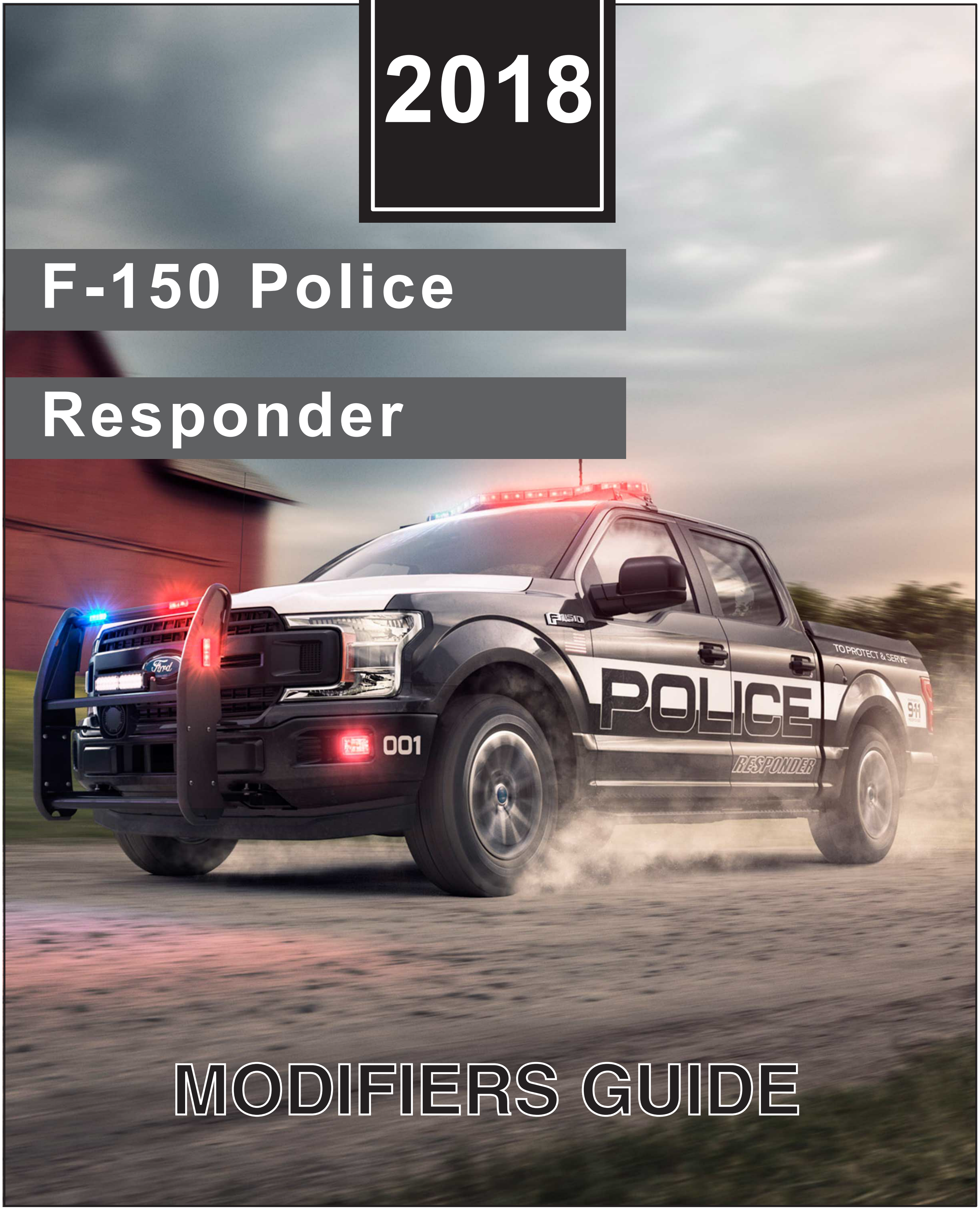
2018

F-150 Police Responder


F-150
TO PROTECT & SERVE
POLICE
911
001
RESPONDER

MODIFIERS GUIDE

Table of Contents

Contents **PAGE**

Introduction 0-2

Introduction

Introduction

Ford Motor Company has assembled this F-150 Police Responder Modifier Guide to assist vehicle modifiers in producing safe and quality products. Ford believes that safety and quality come first.

This book is divided into topics pertinent to modifiers of vehicles. Reference is made to the current Ford Expedition Workshop Manual for appropriate service procedures, torque specifications, component separation clearances and other standard information that is common with the unmodified vehicle. Specifications that are unique to the guide are designated.

This modifiers guide is not a "how-to" book; it should be used as a checklist to help make sure that certain important steps in the modification process are considered. While Ford is providing this information to assist modifiers, it does not warrant the products, methods, materials or the workmanship of the modifier. Nor does it warrant against failures that result from the modification of a vehicle.

Following the guidelines contained in this guide does not assure individual modifiers that the products they modify comply with U.S. Federal or Canadian Motor Vehicle Safety Standards in effect at the time of the modification. The guidelines set forth are based on engineering analyses of typical vehicles. If followed, the modifier's efforts in certifying vehicles to applicable standards should be aided. Compliance testing that may be required for certification of specific vehicle configurations or construction is, however, the sole responsibility of the individual modifier.

Table of Contents

Contents **PAGE**

Section 1: General Information 1-2
  Important Safety Notice 1-2
  Identification Codes 1-2
  Good Practices 1-4
  New Vehicle Storage 1-4
  Tire Pressure Monitoring System (TPMS) Principles of Operation 1-5
  Ambient Temperature Change and Tire Pressure 1-5

Section 1: General Information

Section 1: General Information

Important Safety Notice

NOTE:
The descriptions and specifications contained in this guide were in effect at the time this manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions and guidelines for performing modifications to the F-150 Police Responder SuperCrew®. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools and parts for modifying vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Warnings, Notices and Notes

As you read through this guide, you will come across WARNINGS, NOTICES and NOTES. Each one is there for a specific purpose. WARNINGS remind you to be especially careful in those areas where carelessness can cause you personal injury. NOTICES are given to prevent you from making an error that could damage the vehicle. NOTES give you added information that will help you to complete a particular procedure.

The following list contains some general warnings that you should follow when you work on a vehicle.

⚠ **WARNING:**

- **Always wear safety glasses for eye protection.**
- **Use safety stands whenever a procedure requires you to be under the vehicle.**
- **Make sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.**
- **Set the parking brake when working on the vehicle. The gear selector should be set in PARK unless instructed otherwise for a specific operation. Place wood blocks (4 in x 4 in or larger) against the front and rear surfaces of the tires to help prevent the vehicle from moving.**
- **Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide poisoning.**
- **Keep yourself and your clothing away from moving parts when the engine is running, especially the drive belts.**
- **To reduce the risk of serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tailpipe, catalytic converter and muffler.**
- **Do not smoke while working on a vehicle.**
- **To reduce the risk of injury, always remove rings, watches, loose hanging jewelry and loose clothing before beginning to work on a vehicle.**
- **When it is necessary to work under the hood, keep hands and other objects clear of the radiator fan blades.**
- **Failure to follow these instructions may result in personal injury.**

Making Safety Devices and Elements Inoperative

The vehicle contains many safety features required by Federal or Canadian Motor Vehicle Safety Standards. These features, which include the key-in-ignition chime and brake lights, should never be disabled or modified.

Section 30122 of 49 USC states that "A manufacturer, distributor, dealer or motor vehicle repair business may not knowingly make inoperative any part of a device or element of design installed on or in a motor vehicle or motor vehicle equipment in compliance with an applicable motor vehicle safety standard prescribed under this chapter unless the manufacturer, distributor, dealer or repair business reasonably believes the vehicle or equipment will not be used (except for testing or a similar purpose during maintenance or repair) when the device or element is inoperative."

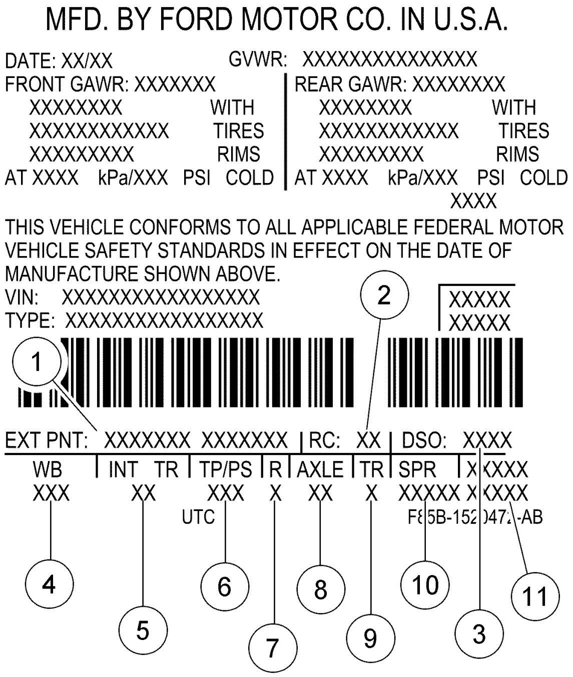
Identification Codes

Vehicle Certification (VC) Label

The upper portion of the Vehicle Certification (VC) label contains the manufacturer name, the month and year of manufacture, the certification statement and the Vehicle Identification Number (VIN). It also includes the Gross Vehicle Weight Rating (GVWR) and the Gross Axle Weight Rating (GAWR), as well as tire size and pressure ratings. The VC label is located on the left hand front door edge.

Section 1: General Information

Vehicle Certification (VC) Label Code Positions


MFD. BY FORD MOTOR CO. IN U.S.A.
DATE: XX/XX
GVWR: XXXXXXXXXXXXXXX
FRONT GAWR: XXXXXXX
XXXXXXXX WITH
XXXXXXXXXXXXX TIRES
XXXXXXXXX RIMS
AT XXXX kPa/XXX PSI COLD
REAR GAWR: XXXXXXXX
XXXXXXXX WITH
XXXXXXXXXXXXX TIRES
XXXXXXXXX RIMS
AT XXXX kPa/XXX PSI COLD
XXXX
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.
VIN: XXXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXXX
XXXXX
XXXXX
EXT PNT: XXXXXXX XXXXXXX
RC: XX
DSO: XXXX
WB XXX
INT TR XX
TP/PS XXX
UTC
R X
AXLE XX
TR X
SPR XXXXX
XXXXX
XXXXX
F85B-1520472-AB
1
2
3
4
5
6
7
8
9
10
11

N0093380

Position	Description
1	Exterior paint code
2	Region code
3	District Special Order (DSO)
4	Wheelbase code
5	Interior trim code
6	Tape/paint pinstripe code
7	Radio code
8	Axle code
9	Transmission code
10	Spring code
11	Powertrain calibration information

11. Powertrain Calibration Information

Section 1: General Information

Powertrain calibration information is located in the lower right corner of the VC label. Only the base calibration information is printed. Revision levels will not appear. Powertrain calibration information is limited to a maximum of 5 characters per line on the VC label. Calibration identification consisting of more than 5 characters will wrap to the second line on the VC label.

Good Practices

Process and Quality Assurance Systems

A formal process and quality assurance system may be helpful in consistently producing high-quality products. An overview of some of the key items for such a system are outlined in this section.

Quality Assurance

Completed Unit Sign-Off: All control items should be inspected with a written sign-off. All labels should be inspected and signed off, including verification that the information on the labels is correct. All appropriate systems should be checked for leaks. A road test should be performed to verify that all systems are operating correctly. All systems and functions that were provided by Ford should be checked to make sure that they function correctly after the build process.

The modifier's process and quality assurance systems should also make sure appropriate training is provided to the employees.

Minimum and Maximum Screw Sizes

When installing aftermarket equipment, avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system and suspension. Details for mounting equipment in the trunk, as well as appropriate fasteners, can be found in Section 4, Cargo Mounting Considerations.

New Vehicle Storage

New Vehicle Storage — General

- Vehicles should be stored in a dry, ventilated place, and protected from sunlight, if possible.
- If vehicles are stored outside, maintenance against rust and damage, as described below, is recommended.

NOTICE:
Keep all rubber parts free from oil and solvents. Damage to rubber parts can occur.

New Vehicle Storage — Body

- Thoroughly wash the vehicle thoroughly to remove dirt, grease, oil, tar or mud from exterior surfaces and underside of front fender.
- Periodically wash vehicles stored in exposed locations.
- Touch up exposed raw or primed metal to provide rust protection.
- Cover chrome and stainless steel parts with a thick coat of auto wax to prevent discoloration. Rewax as necessary when the vehicle is washed.
- Lubricate all hood, door hinges and latches with a light grade oil.
- Cover the interior soft trim to prevent fading.

New Vehicle Storage — Engine

- Start the engine every 15 days. Run it at fast idle until it reaches normal operating temperature.
- Apply the brakes and shift the transmission into all gears while the engine is running.

New Vehicle Storage — Fuel System

- Regularly move the vehicles short distances to mix fuel anti-oxidation agents.

NOTICE:
During extended periods of vehicle storage (60 days or more), gasoline may deteriorate due to oxidation. This can damage rubber and other polymers in the fuel system and may clog small orifices. Add commercially available gasoline fuel stabilizer (Sta-Bil or equivalent) to gasoline-powered vehicles whenever actual or expected storage periods exceed 60 days. Follow the manufacturer's instructions packaged with the product. Operate at an idle speed to circulate the additive throughout the fuel system.

New Vehicle Storage — Tires

Section 1: General Information

Most high-performance tires are made with nylon overlay.

The following steps should be taken to avoid flat spotting when the vehicles are not used for a period of time.

- Keep the vehicle's tire pressure at the recommended operating pressure.
- If the vehicle is stored for periods longer than 15 days, it should be moved several feet at least once during each 15-day period so that a different portion of the tread contacts the ground.

Tire Pressure Monitoring System (TPMS) Principles of Operation

The Body Control Module (BCM) uses tire pressure sensors to monitor tire pressure. The sensors use radio signals to transmit the tire pressure to the Tire Pressure Monitor (TPM) module. The TPM module sends the information to the BCM over the MS-CAN. The tire pressure sensors are battery operated and mounted to the valve stems. The Instrument Panel Cluster (IPC) illuminates the TPMS warning indicator and the message center displays a message when a fault is present or when the tire pressure falls below the low pressure limit.

This vehicle, as delivered by Ford Motor Company, conforms to Standard FMVSS138, Tire Pressure Monitoring Systems.

This system may not function if any of the following components are removed, relocated or modified in any way:

- OEM wheels and tires
- Tire pressure sensors
- BCM
- BCM software and calibrations
- IPC
- IPC software and calibrations
- Instrument panel wiring
- Wheelbases greater than originally released
- The addition of modifier harnesses near, over and around the TPM module. These harnesses can cause the loss of the TPMS signal to the TPM.

Certain modifications could reduce system performance, including the complete loss of TPMS functionality. These may include:

- Non-OEM wheels or tires.
- The addition of steel carcass or run-flat tires.
- Removal of tire pressure sensors, cradles or bands.
- Modification of the recommended tire pressure.
- Modifications to the mounting location of the BCM.
- Modifications or relocation of the harness supplying the BCM and IPC modules.
- Addition of metallic structures, such as prisoner partitions, may affect the signal strength of the sensors and could interfere or prevent the TPM module from communicating the sensors.
- Addition of intended or unintended transmitters to the vehicle may affect the signal strength of the sensors or interfere with the TPM module internal antenna.

The TPMS, as delivered from the Ford Motor Company, complies with part 15 of the FCC rules and with RS-210 of Industry Canada. Operation is subject to the following 2 conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Ambient Temperature Change and Tire Pressure

NOTICE:
Do not inflate the tire higher than the maximum pressure stamped on the tire sidewall. Premature tire wear or damage to the tire may result.

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the TPMS and illuminate the TPMS warning indicator.

Section 1: General Information

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified Vehicle Certification (VC) label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

**** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. ****

Table is based on a Garage Temperature of 70°F. Max Pressure Adjustment is 7 psi.

	Tire Placard Pressure (PSI)																	
Outside Temperature (°F)	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[2]

**** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. ****

Table is based on a Garage Temperature of 21°C. Max Pressure Adjustment is 50 kPa.

	Tire Placard Pressure (kPa)																	
Outside Temperature (°C)	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1] When outside (ambient) temperature is greater than 21°C (70°F), inflate tires to placard pressure.

[2] Use the table to adjust tire pressure for P-metric and LT tires only.

N0079118

Table of Contents

Contents **PAGE**

Section 2: Electrical 2-2
- Electrical Basics 2-2
- Electrical Systems Management 2-2
- Generator Output 2-2
- Charging Margins 2-2
- Powertrain Control Module (PCM) — Red Area 2-4
- Disabling Brake Lights 2-4
- Auxiliary Power Point (12V DC) 2-4
- Sealing Pass-Thru Points/Openings 2-4
- Sealing Option For Body Openings/Pass-Through Points 2-5
- Decommissioning 2-5
- General Guidelines 2-6
- Splices and Repairs 2-12
- Electrical items for the F-150 Police Responder 2-16
- Dash Panel Pass Through From The Battery To Cab Interior 2-17
- Park Signal (PDS – Park Detect Switch) 2-17
- Brake Signal 2-17
- Battery Power Access Points 2-17
- Ignition Power (Run/Start) Signal 2-18
- Vehicle Speed Output 2-19
- Driver Door Ajar 2-19
- Delayed Accessory 2-20
- Battery Saver 2-21
- Body Control Module (BCM) 2-22
- How To Change Option Content 2-22
- Rear Power Window Disable 2-22
- Wiring Reference Information 2-22

Section 2: Electrical

Section 2: Electrical

Electrical Basics

Inside a vehicle, electricity is supplied through powered, or hot, wires. This is comparable to the pressurized supply pipes of a plumbing system. At various points along the wires are outlets in the form of lights, switches and receptacles. Turning on a light switch allows the electric current to flow through the hot wire to illuminate the light. Once the electricity has done its work, its potential drops to zero, just as water loses pressure after flowing through a sink or laundry tub. The electrical system uses ground wires to return the current to its source. Just as a plumbing system has drainpipes through which water runs into the sewer mains or the ground.

The light or equipment powered by the current, technically called the load, can be compared to a water wheel that remains motionless until a stream of water causes it to turn. A load may be one of 2 kinds. The first consists of a resistance — a material that permits the passage of electric current, but only with difficulty, and thereby creates heat. The tungsten filament of an incandescent bulb is resistance; so is the heating element of an electric heater of a coffee pot. A load may also be an inductance — typically a motor with windings of copper wire, in which the magnetic fields generated by the current create motion. At any moment, the demand on an electrical system depends on the number of loads in operation and their consumption of energy, just as demand on a water system depends on how many faucets are opened and how wide they are opened.

The mechanics and physical fittings of the system are simple. Current moves throughout the vehicle in wires of different sizes, according to the current a circuit may have to carry. Power is supplied directly to equipment through connectors.

Electrical Terms

VOLT is the unit of electrical potential, equal to the difference of electrical potential between 2 points on a circuit.

AMPERE is the unit used to measure the amount of current - that is, the number of electrically charged particles called electrons - that flows past a given point on a circuit each second. It is similar to measuring the amount of water flowing through a pipe at any given point. The larger the pipe is, the more water that can flow past the point per second. Similarly, the bigger the wire is, the more current that can flow through it at any given point. Current that has lost its voltage still has amperage as it completes the circuit and returns to the battery.

WATT is the unit of power. It indicates the rate at which a device converts electric current to another form of energy, either heat or motion, or to put it another way, the rate at which a device consumes energy.

The relationship of volts, amperes and watts to one another is expressed in a simple equation that enables you to make any calculations you may need for correct and safe electrical modifications to the vehicle. Volts x amperes = watts. If the current is at 12 volts and a device requires 4 amperes of current, the equation will read 12 volts x 4 amperes = 48 watts.

To figure the current needed for a device rated in watts, turn the equation around: watts/volts = amperes. For example, if you have a piece of equipment, such as a communications radio, that uses 120 watts: 120 watts/12 volts = 10 amperes.

Electrical Systems Management

Care must be given in deciding what equipment should be installed into a police vehicle given the power demands of the equipment and the power available from the vehicle. A power load strategy should be developed to minimize the risk of running out of power. Examine the proposed equipment for vehicle installation. Add up the current requirements. If the current requirements exceed what the vehicle can reasonably be expected to be able to provide, the battery will begin discharging to provide the power to the equipment that the generator is unable to provide. After some period of time, the vehicle will shut off as the battery voltage decreases to a level that cannot sustain vehicle operation.

There are alternatives that can be considered to minimize system electrical overload. Consider the current requirements of equipment before it is purchased and installed. Modern light bars and radios use a fraction of the current than units made as recently as 1996. As the light bar is typically the most power intensive unit installed on most police vehicles, considerable attention should be given to its current requirements. Changes in officer habits while in the field can make a difference as well. When a vehicle is sitting at an accident scene and no one is in the car, the A/C can be turned off until the officer is ready to get back into the vehicle. The A/C is among the largest current users of non-police equipment. As such, it can impact available power for other uses as well.

Generator Output

The 240 amp generator used by the F-150 is controlled by the Powertrain Control Module (PCM).

Charging Margins

Generator output varies with engine speed and ambient temperature. The worst case for police vehicles is when the vehicle is idling for long periods of time on a very hot day. Lower engine speeds while idling, coupled with high underhood temperatures that may approach 93°C (200°F), combine to minimize power output from the generator. At the same time, electrical demand on the vehicle is often at its highest because the A/C loads are added to the usual electrical loads experienced in emergency situations.

Vehicle Component Electrical Loads

Section 2: Electrical

Vehicle component electrical loads are shown in the table below. Not all features are powered all the time, so actual vehicle loads on the power supply system will vary.

Component	Amps
Base	
Miscellaneous base loads	19.6
Cooling	
Cooling fan (increase high) 800W X 75%	43.4
Climate Control	
A/C clutch	3.3
A/C Fan-to-Face — High Speed	21.3
A/C Fan-to-Face — M/H Speed	17.2
Heater Fan-to-Foot — M/H Speed	12.2
Heater Fan — Defrost — High Speed	16.9
Rear climate control	56.8
Lighting	
Exterior and Instrument Panel Lamps (non-dimmable)	3.2
Headlamps — Low Beam	8.9
Headlamps — High Beam (incremental)	9.9
Incandescent brake lights with CHMSL	10.7
Heated Features	
Heated rear windows	21.4
Other	
Radio	6.0
Front wiper low speed	4.0
Electric trailer brake	8.0
Typical Vehicle Load = 140- 170 Amps	

Typical Police Equipment

Loads for equipment commonly found on police vehicles are shown in the table below. Not all equipment will be operating at the same time, so actual loads on the power supply system will vary.

Component	Amps
Communications radio	4.0 (8.0 with microphone active)
Mobile data transmitter	3.0
Light bar	28-43
Light bar with all internal accessory lights activated	36-63
Spotlights (each)	7.8
Alley lights (each)	1.0
Radar	0.8
Camcorder	0.5

Section 2: Electrical

Powertrain Control Module (PCM) — Red Area

NOTICE:
DO NOT make electrical connections to vehicle electrical systems not specifically designed for police equipment installations. Damage to the electrical system can occur.

Do not install any components into the PCM or PCM harness. Connecting into this system may affect engine and transmission operation. Connecting any aftermarket electrical equipment into the brake light circuit or any other circuit connected to the PCM, anti-lock brake computer, air bag system or any other vehicle system will cause a vehicle malfunction.

Disabling Brake Lights

Do not disable the brake light circuits for any reason. For additional information, refer to Section 1: General Information in this guide.

Auxiliary Power Point (12V DC)

NOTICE:
Do not plug optional accessories into the cigar lighter socket (if equipped). Incorrect use of the lighter/socket can cause damage not covered by the warranty.

NOTICE:
Power outlets are designed for accessory plugs only. Do not insert any other object in the power outlet as this will damage the outlet and blow the fuse. Do not hang any type of accessory or accessory bracket from the plug. Incorrect use of the power outlet can cause damage not covered by the warranty.

The auxiliary power point is located on the instrument panel. Do not use the power point for operating the cigar lighter element (if equipped). To prevent blowing the fuse, do not use the power point(s) over the vehicle capacity of 12V DC/180W. If the power point or cigar lighter socket is not working, a fuse may have blown. To prevent the battery from being discharged, do not use the power point longer than necessary when the engine is not running. Always keep the power point caps closed when not being used.

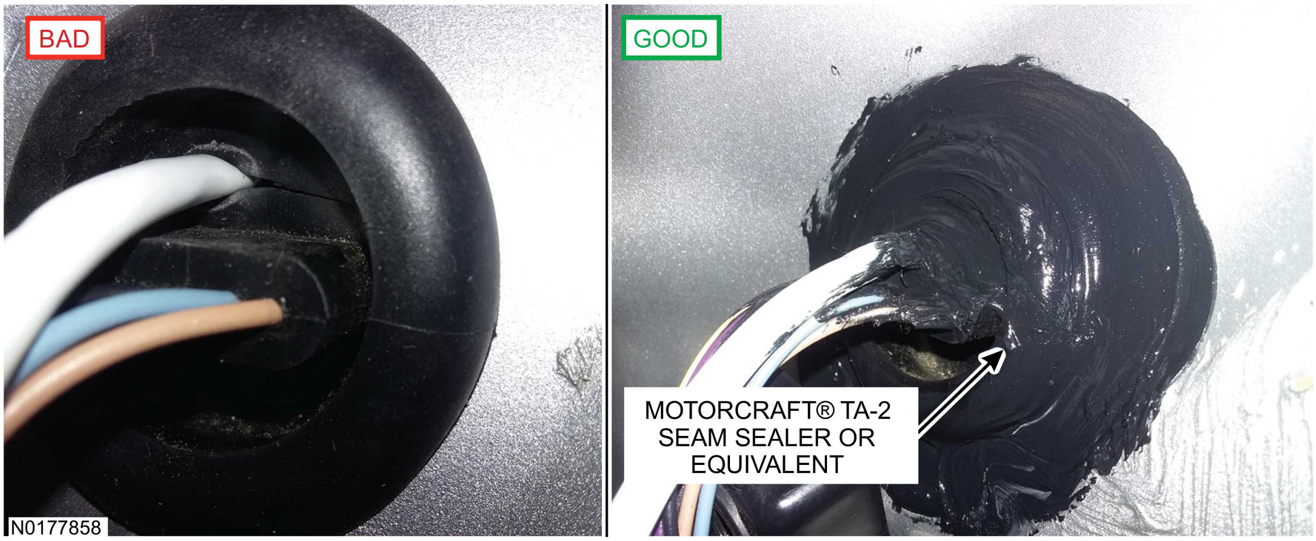
Sealing Pass-Thru Points/Openings

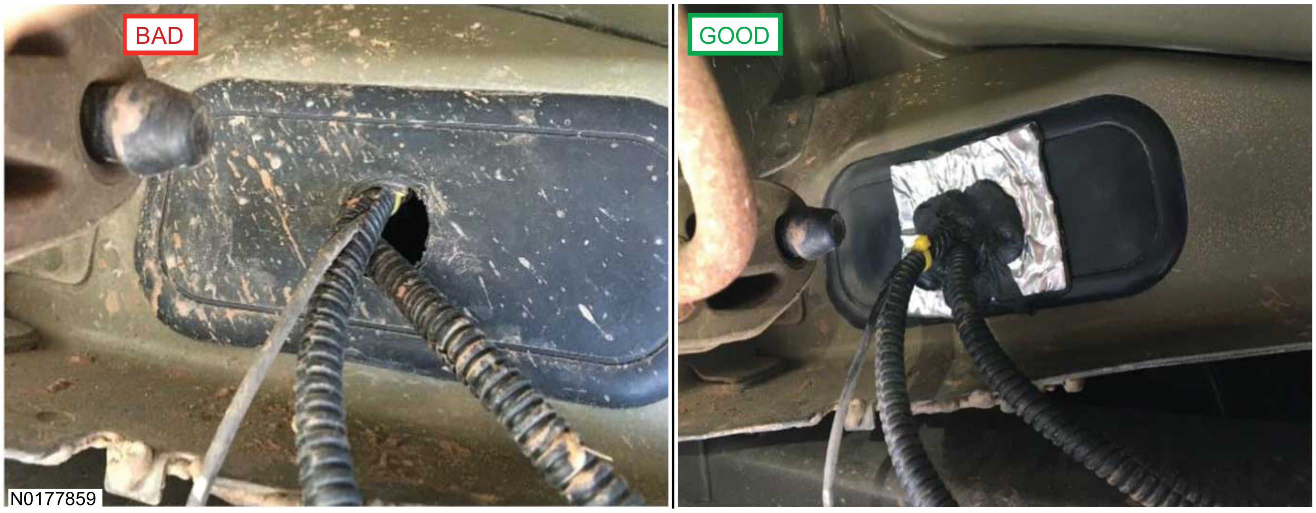
Underbody

- Any holes in the body must be sealed with Motorcraft® Seam Sealer (TA-2-B).
- Any damaged parts must be replaced. Following are some examples:
- spare tire tub
- auxiliary A/C pass-through
- air extractors (replace if damaged)
- wiring grommets
- body plugs
- floor pan

Examples of wiring pass-throughs that were sealed incorrectly and correctly Proper care and due diligence must be used on all openings at any location on the vehicle from the dash panel to the rear of the vehicle.

Section 2: Electrical





Dash Panel

Any seals and/or holes in the dash panel must be replaced and/or properly sealed using Motorcraft® Seam Sealer (TA-2-b).

Sealing Option For Body Openings/Pass-Through Points

- Pass-through or other openings of similar size should be sealed using the recommended foil-backed mastic patch.
- Foil-backed mastic patch should be used to cover and seal body openings.
- Part number for foil-backed mastic patch:
- Following are service part numbers for two different size foil-backed mastic patches:
- 4L3Z18203A16AA; size of patch - 1.5 x 147 x 330mm
- DA5Z65203A16A; size of patch - 1.5 x 100 x 300mm

Decommissioning

Vehicle Sealing of Aftermarket Equipment

At the end of its useful life as a police vehicle, many vehicles are decommissioned having lights, wiring and other equipment removed and vehicles are sold for other uses such as retail applications. The openings remaining in the body/components are potential leak paths for exhaust gas into the cabin under certain conditions. These openings must be sealed prior to the vehicle going to auction or any other application.

Section 2: Electrical

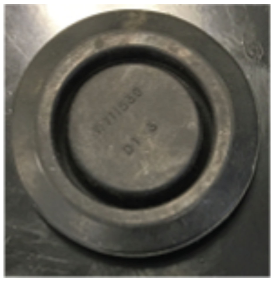
When customized equipment has been removed from your vehicle, body panels and seals may be compromised. Thoroughly inspect your vehicle for any signs where the equipment has been removed, for example: holes and damage to body seals.

Any openings should be sealed with a plug and a sealant. The opening can be modified to enable a plug to seat properly promoting a better sealing surface. The sheet metal surface with the opening should be treated to prevent corrosion prior to inserting the plug and sealant.

Any items that remain on your vehicle must be inspected and any sign of damage repaired immediately. Failure to follow this instruction may result in water and exhaust fumes entering the passenger compartment.

See your authorized ford dealer for more information and direction regarding proper sealing procedures.

N0178256



Common Ford Plug Part Number	Hole Diameter
W716284–S	0.859 inches / 21.83 mm
W714104–S	1.07 inches / 27.25 mm
W711539–S	1.378 / 35.0 mm
W651021–S	1.683 inches / 42.75 mm

Tools For Creating A Circular Opening

Two suggestions for tools that can be used for creating and/or modifying an existing opening for a plug are a Knockout Punch or Step Bit.

N0178257

General Guidelines

- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Document all revisions to the electrical system and place with the vehicle Owner's Literature. Color code and/or label all revisions or additions to wiring.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Disconnect the negative battery cable of vehicles stored on-site to reduce the possibility of draining the battery by lights or other equipment.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 5: Reference Information in this guide.
- Do not install switches and gauges in the driver or passenger knee impact areas.
- Inspect all Ford gauges, lights and switches for correct operation after instrument panel work is performed.
- Correctly secure all wiring relocated or removed while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Provide adequate retention for wiring harnesses so that they are clear of bolts, corners or edges which could abrade the wires during normal vehicle operation.

Section 2: Electrical

- Anticipate misrouted wiring situations and protect all wiring from penetration by screws and raw edges. See Wire Routing for further information.
- Weather seal all exposed electrical connections exposed to the elements.
- Do not use quick splice connectors or wire nuts.
- Install the fuse panel so fuses are readily accessible.
- Make sure that connections are easily accessible for assembly and service.
- Make sure submersible connectors do not lose their seals under extreme assembly conditions such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.
- Supplemental restraint systems must remain intact as received from Ford Motor Company. Before modifications are done to the vehicle, the system must be disarmed by following the instructions provided in the current F-150 Workshop Manual.
- Adherence to the above guidelines is not to be understood as approval by Ford Motor Company of any specific revisions or additions to the vehicle's original electrical system.

Keep Alive Memory (KAM) Power

The electronic engine and transmission control modules require battery power to be supplied at all times to maintain the KAM. Keep this in mind when installing load disconnect switches or solenoids.

Equipment Grounding Guidelines

- Factory ground locations are not to be removed for any reason.
- Do not ground the body to the transmission or transmission crossmember. Ground accessories to the chassis or the vehicle battery.
- Splicing into circuitry relating to the electronic engine and/or transmission control systems is not acceptable because of the adverse effect on the electronic system operation.
- Protect exposed electrical connections.

Wire Insulation

- Polyvinyl Chloride (PVC), rated at 90°C (194°F), is the standard wire insulation that is acceptable for inside body use, but is not acceptable for underhood/underbody wiring.
- Hypalon insulation should be used on links only (Ford Specification ESB-M1L54-A).
- Cross-linked Polyethylene (XPLPE or SXL), rated at 135°C (275°F), is the required insulation for underhood/underbody applications (Ford Specification ESB-M1L123-A).
- GXL can be used as an alternate wire (Ford Specification ESB-M7L85B) as long as the concentricity specifications are met. To provide a water-resistant seal in conjunction with crimp connectors, a Duraseal crimp connector is recommended since it is designed to account for outside wire diameter that is smaller than the present SXL wire.

Terminals and Connectors

Connector Types

- Submersible (sealed) — A connector capable of being immersed in water.
- Weather-resistant — A connector that will retain its sealing and connection qualities while being exposed to adverse weather conditions.
- Duraseal crimp — A supplier trade name for a sealed wiring repair or splice.

When a connection is not defined (typical situation — harness-to-harness connectors), the following suggestions should be implemented:

- Determine the connector type. If it will be located in a hostile environment, use a submersible (sealed) connector; if not, use an open connector. A hostile environment is defined as being exposed to water and/or salt accumulation and/or high temperatures (for example, underhood, exterior panels and footwells). Use in-line connectors with secondary locks to prevent the terminal from being pushed out.
  - Do not use single wires smaller than 14-gauge in a 2-way or larger weather-resistant connector (the very large style), since the wire may break during disengagement.
  - Use Hypalon, XLPE or Elexar insulation in submersible connectors to maintain sealing integrity. PVC is not acceptable because it cold flows and allows setting in a deformed pattern, therefore compromising the integrity of the seal.

- Determine the terminal type. Base your decision on wire gauge, current carrying capacity, connector type and insulation type.
  - Use non-detent low insertion force terminals whenever possible.
  - Do not use low insertion force female terminals in weather-resistant connectors.

Section 2: Electrical

- Analyze circuit requirements (signal levels, current, voltage) to determine the correct plating material (such as gold). Use of non-plated terminals is not recommended.
- Do not use plugs to seal holes in micropin connector grommets. It is very easy to forget to insert them during manufacturing and ruin the seal. Use a grommet with only the necessary number of holes or use dummy wires at least 600 mm (24 in) long.
- Fully align connectors prior to terminal connection — terminal cavities should have minimum tolerance to prevent terminals from floating, bending or pin push-out during mating/engagement.
- Make sure connectors of similar type and color can be identified by operator to eliminate crossed connections and minimize assembly time. Avoid using similar types and colors of connectors close together.
- Be sure that connectors have positive locking devices that allow easy installation with a low insertion force and easy removal. The connector snap should be easily felt and heard.
- Eliminate the use of edgeboard, tang-type and molded-over connectors. The use of blade-type weather-resistant connectors is restricted to high-current applications which cannot be handled by submersible connectors.

Circuit Protection and Electrical Load

- Modification to existing vehicle wiring should be done only with caution and careful consideration of effects on the completed vehicle electrical system. Anticipated circuitry should be studied to determine the required circuit protection and to avoid feedback loops.
- Added circuitry must be protected either by a base vehicle fuse or circuit breaker, or by a similar device supplied by the modifier.
- When adding loads to a base vehicle-protected circuit, make sure that the total electrical load through the base vehicle fuse or circuit breaker is less than the device's load rating.
- Use 80% of the fuse rating to determine maximum steady state load to reduce nuisance fuse failures.
- Use 135% of the fuse rating when sizing wiring to protect the circuit in the event of an overload. Fuses will last for 1 hour at 135% of their rating.
- Total current draw is the sum of the base vehicle's circuit current requirement (measured with an ammeter) and the anticipated add-on component current requirements.
- Never increase the rating of a factory installed fuse or circuit breaker.
- If the total electrical load including additional electrical components on any circuit, is less than the fuse protection rating or the capacity of some limiting component (switch, relay), the items to be added can be connected directly to that circuit. The headlamp switch circuits should never have additional lighting or electrical components directly connected.
- Added devices that exceed the current capabilities of the factory-installed system are best controlled through the use of a relay or separate switch. The coil of the relay can be fed from the circuit in the factory harness (now acting as a signal circuit) with added wiring providing feeds to the added electrical device. The relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time and whether the relay is exposed to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, the load should be reduced or divided through the use of additional relays.

Wire Protection Requirements

General Notes

- Anticipate problems and design accordingly. Try to anticipate what could go wrong and modify your designs to address any adverse impact.
- Review all connector applications and electrical systems to determine the need for solder, grease, weather-resistant or sealed connectors. Make sure components and wire insulation are compatible with greased connectors (important for long-term durability).
- Make sure that drip loops or other means are provided to prevent water leakage into the vehicle through wiring assemblies that pass through the dash panel.
- Use greased or sealed connectors in floor pan troughs which are subject to moisture coming through the carpeting.
- Use XLPE insulation for uncovered runs that exceed 305 mm (12 in).

Electrical Protection

- Correctly route wires away from noise-generating wires or components. However, if routing near noisy wires or plugging into noisy components is unavoidable, additional protection must be designed into the harness.
- Shielding — Electro Magnetic Interference (EMI) — Consider shielding if you must route close to high-current or noisy circuits. Use shielded wire and ground one side. Seal all splices in wire assemblies that use bare coaxial shielding (braid or tape) for EMI suppression, and insulate or tape over all shielding ends that terminate near any open connectors. This prevents splice and terminal shorts to the shielding. Minimize the length of conductors which extend beyond the shield. Failure to do this reduces the effectiveness of the shield.
- Spike suppression, in general, is accomplished by connecting a diode or resistor-diode combination across the terminals of the noisy component. The diode should be sufficiently close to the component (both electrically and physically) so that inductive spikes are clamped off. Make sure the diode is connected with the correct polarity.

Correct routing and retention will reduce the likelihood of chafing or pinching. When this ideal routing is unattainable, the following additional protection is needed:

Section 2: Electrical

Mechanical/Environmental Protection

- Tape — Tape is the most basic means of protection. It contains the wires in a loose bundle and provides limited environmental protection. It does not protect against chafing and pinching.
  - Kendall Polyken Fiberglass Base Tape (Ford Specification ESB-M3G38-A) is used for engine compartment applications. This durable tape provides against cut-through and abrasion commonly found in underhood applications.
  - Polyken 267 is a substitute tape that may be used in lower temperature areas of the engine compartment (apron area).
- Convolute - Use convolute for all underhood/underbody applications or when increased temperature, abrasion or pinch resistance is required. Convoluted tubing comes in different diameters and materials to accommodate different temperature ranges and harness sizes.
  - Use polyethylene convolute when abrasion is the only consideration; this convolute is adequate up to 96°C (205°F) maximum. Use nylon convolute when underhood/underbody or abrasion and temperature are considerations; nylon convolute is adequate up to 177°C (350°F) maximum.
  - On all engine-mounted wiring or bend points, use vinyl tape on the outside of the convolute to prevent wiring from looping out. This tape must be able to withstand temperatures 135°C (275°F) or higher.
  - Tape convolute junctions with abrasion-resistant tape (Polyken 267, fiberglass).
- Scroll — Similar to convolute, but without the ridges. Scroll is used where harness rigidity is required, especially for maintaining critical locator dimensions. Use scroll for short lengths only, as it is quite inflexible.

NOTE:
This is not meant to be an all-inclusive list of methods for physically protecting the wires. There are other means of protection available that are not listed.

Grommets and Sealing Requirements

Any additional wiring routed through sheet metal must pass through a grommet that both seals the opening and locates the wire(s). Two-piece grommets (rubber with plastic inserts) are recommended to facilitate installation and retention.

- Locate grommets so they are accessible for correct seating (achieved by pulling) in sheet metal holes.
- Ramp grommets at the insertion end to facilitate installation and sealing.
- Be sure the direction of the hole punch is in the direction of grommet seating and the hole is burr-free.
- Make sure the grommet molding compound will adhere to the harness to prevent slippage.
- Make sure the grommet will withstand the environment (temperature, splash).
- Be sure that holes are large enough to allow the harness to be installed without causing circuit damage.
- Use adhesive tape on main trunks or branches with at least a 50% overlap to prevent wicking through grommets. Be certain to diaper-wrap the takeouts.

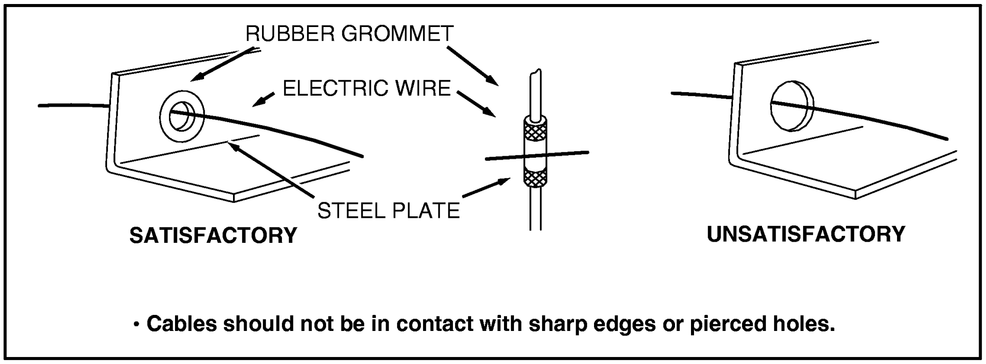
Wire Routing

⚠ **WARNING:**
Do not place electrical component attachments or ground screws adjacent to vehicle fuel tanks, fuel filler pipes, fuel lines, fuel vapor lines or carbon canisters. Failure to follow these instructions may result in personal injury in the event of a collision.

Wire harness routing should conform to the following:

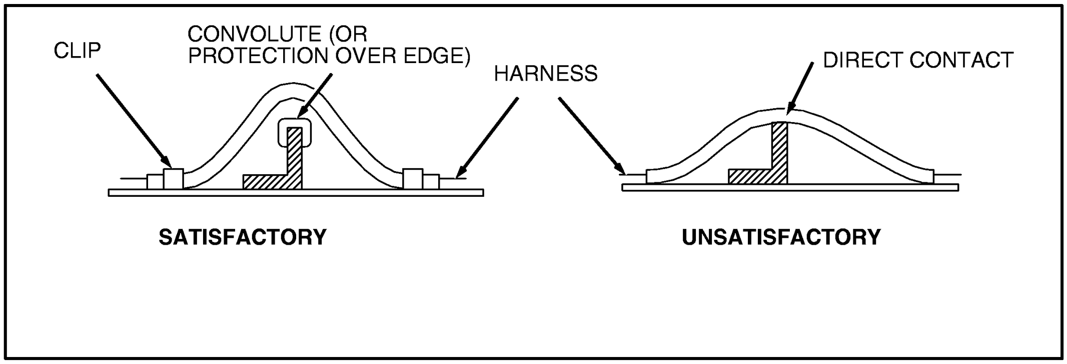
- Protect wires routed through holes in sheet metal or castings with a grommet whether or not conduit is used (see figure below).

Section 2: Electrical


RUBBER GROMMET
ELECTRIC WIRE
STEEL PLATE
SATISFACTORY
UNSATISFACTORY
• Cables should not be in contact with sharp edges or pierced holes.

A0073515

- Route wires to avoid metal edges, screws, trim fasteners and abrasive surfaces. When such routing is not possible, use protective devices (shields, caps) to protect the wires. Cover metal edges with a protective shield and fasten the wiring within 76 mm (3 in) on each side of the edge (see figure below).


CLIP
CONVOLUTE (OR PROTECTION OVER EDGE)
HARNESS
DIRECT CONTACT
SATISFACTORY
UNSATISFACTORY

A0073514

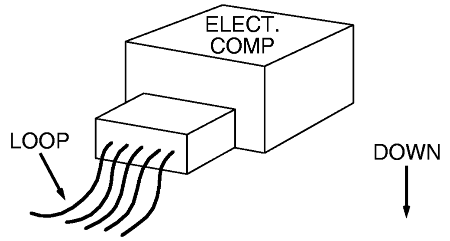
- Route wires to provide at least 76 mm (3 in) of clearance to moving parts in their extreme movement location, unless positively fastened and protected by a conduit.
- Avoid wire routing without conduit in areas where temperatures exceed 82°C (180°F). Maintain a minimum clearance of 152 mm (6 in) from exhaust system components. Heat insulation and heat shields must be used on the wires routed in high temperature areas.
- Make certain all underhood or underbody wiring is cross-linked polyethylene high temperature insulation wire with a 135°C (275°F) minimum rating, consistent with SAE specification J1128 Type SXL wire. Do not use normal PVC wire in underhood or underbody applications.
- Make sure all ground locations are readily accessible for installation, service and verification.
- Do not place ground attachments in high-splash areas.
- Do not route underbody wiring over the exhaust system.
- Route the underhood/underbody wiring in conduit for protection. Minimum conduit rating is 177°C (350°F).

Wire Retention and Routing

Use the following criteria to determine the location of retainers:

- Size and weight of wire bundle.
- Holes with poor accessibility that prevent installation of locators.
- Movement of wires that can result in abrasion, squeaks and rattles.
- When wiring is routed between 2 members where relative motion can occur, secure the wiring to each member with enough wire slack to allow flexing without damaging the wire.
- Wiring exposed to weather must provide a drip loop to prevent moisture from being conducted into the device through the wire connection (see figure below).

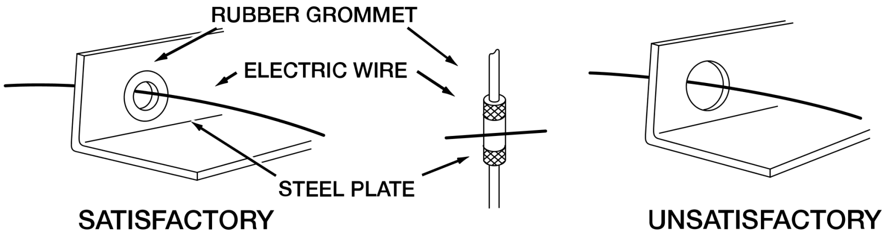
Section 2: Electrical


ELECT.
COMP
LOOP
DOWN

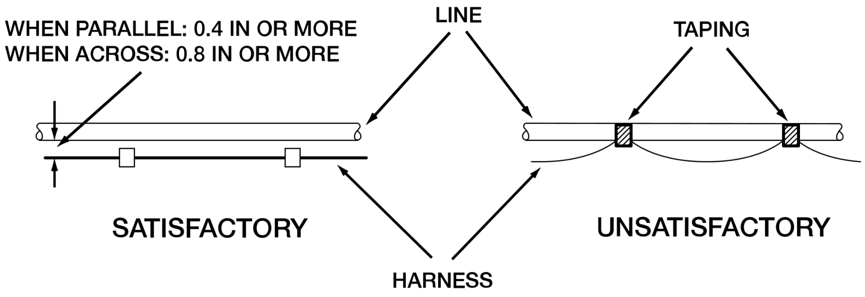
• Drip loops should be provided at connectors and grommets to direct water away from terminals or inside the vehicle.

A0073517

- Avoid routing wires into areas exposed to wheel splash. When such routing cannot be avoided, adequate clipping and/or protective shields are required to protect the wires from stone and ice damage. Allow adequate slack in wiring between the engine and stationary components to compensate for engine roll.
- Avoid routing wires under the frame side members or at points lower than the bottom frame flange.
- Use plastic cable ties for bundling only (securing to other wires).
- The wire retainers and grommets installed by the assembly plant are usually designed to accommodate only the Ford-installed wires. Additional wiring or tubing should be retained by additional clips. When additional wiring or tubing are routed through sheet metal panels, new holes with correct wire protection and sealing must be used.


RUBBER GROMMET
ELECTRIC WIRE
STEEL PLATE
SATISFACTORY
UNSATISFACTORY

• Cables should not be in contact with sharp edges or pierced holes.


WHEN PARALLEL: 0.4 IN OR MORE
WHEN ACROSS: 0.8 IN OR MORE
LINE
TAPING
SATISFACTORY
UNSATISFACTORY
HARNESS

• Harnesses should not be taped to fuel lines or other lines. A sufficient clearance should be maintained between harness and lines.

N0149584

For retainer screws, the following guidelines apply:

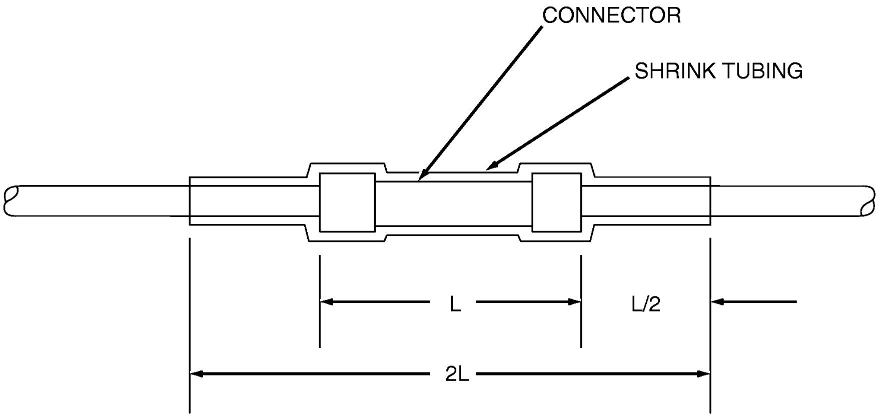
Section 2: Electrical

- Avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system and suspension.
- Do not use pointed screws for attachments. Also check that screws used in the vicinity of the wiring are blunt-ended.
- To minimize the potential for wiring shorts, do not use drill point screws. Trim components (including wiring shields) should use pin-type attachments instead of screws.
- Always check areas that screws protrude into for verification that an interference condition to other components does not exist.
- Make sure that retainers used are capable of withstanding the environment over the vehicle's life expectancy.

Splices and Repairs

For quality splicing and to reduce potential problems, the following guidelines are recommended:

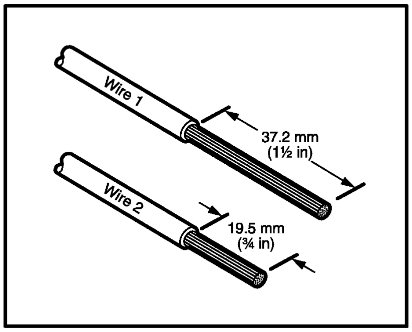
- Stagger the splices within a harness to reduce increased harness diameter. Splice only on straight areas as installed, not on bends.
- Strip wire ends making sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only resin-core solder. Acid-core solder should not be used since it may result in corrosion.
- For crimp joints, use butt-type metal barrel fasteners and the correct tool at the appropriate setting for the wire size (such as Motorcraft® Crimp Tool S-9796) specifically designed for this type of work.
- Make sure splice joints are adequately sealed and insulated. In an outside environment, use Duraseal butt connectors or equivalent. A durable substitute splice joint can be achieved by using a bare metal barrel, crimping, flow-soldering and covering with shrink tubing. Quality electrical tape can be used inside the vehicle, but is not recommended for an outside environment.
- Be sure the new wire is not a lesser gauge than its original mating wire.



A0074039

Recommended Splicing Method — Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect the battery ground cable.
2. Strip wires to appropriate length.

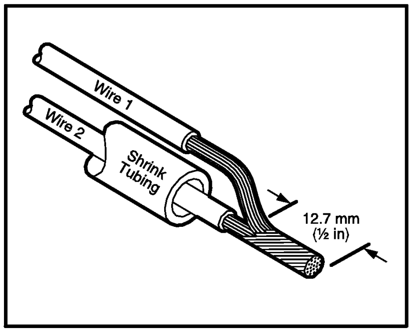


A0075761

Section 2: Electrical

3. Install heat shrink tubing.
4. Twist the wires together.
5. **NOTE:**
   Use resin-core mildly-activated (RMA) solder. Do not use acid-core solder.

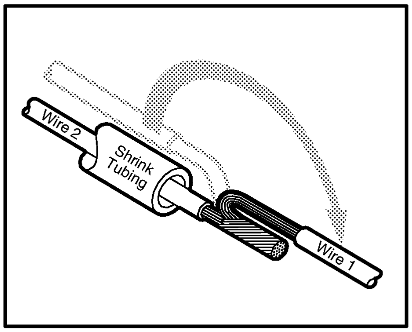
   Solder wires together.


Wire 1
Wire 2
Shrink Tubing
12.7 mm
(½ in)

A0075762

6. **NOTE:**
   Wait for solder to cool before moving wires.

   Bend wire 1 back in a straight line.

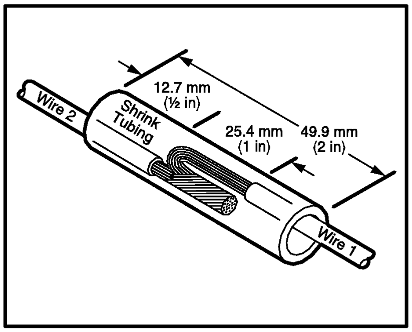

Wire 2
Shrink Tubing
Wire 1

A0075763

7. **NOTE:**
   Overlap tubing on both wires.

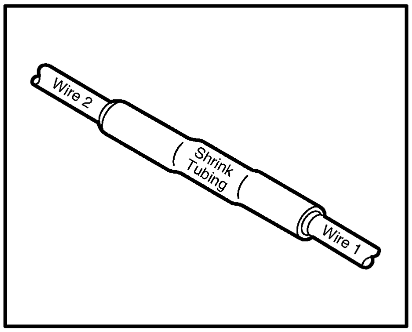
   Evenly position heat shrink tubing over wire repair.

Section 2: Electrical



A0075764

8. Use a shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing.



A0075765

9. Reconnect the battery ground cable.

Sealed Connectors

Ford Part Number	Part Name	Class
E6FZ-14488-A	Butt Connector Gauge: 18-22, Color: Red	C
E6FZ-14488-B	Butt Connector Gauge: 14-16, Color: Blue	C
E6FZ-14488-C	Butt Connector Gauge: 10-12, Color: Yellow	C

Heat Shrinkable Tubing (Heat Shrink) (Ford Specification ESB-M99D56-A2)

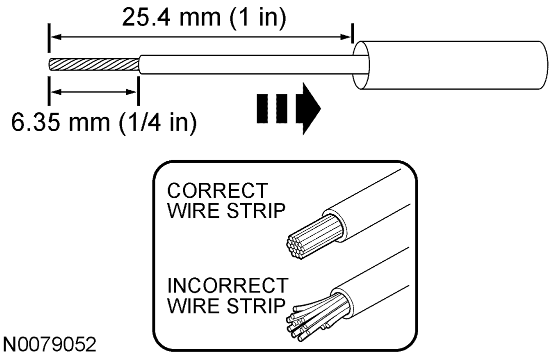
Heat shrinkable tubing is available in various diameters for different splice sizes and configurations. When shrunk, it forms a small, flexible hermetic seal.

Other methods (tape, PVC mold) do not provide a hermetic seal and are not recommended. Splice balancing is critical with heat shrink insulation. If the splice is extremely unbalanced (more circuits on one side than the other), heat shrink insulation will not provide a correct seal. Evaluate the use of double terminals instead of splices where practical in these situations.

Recommended Splicing Method — Crimp (For 10–22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect the battery ground cable.
2. Strip wires to appropriate length.
3. Install heat shrink tubing.

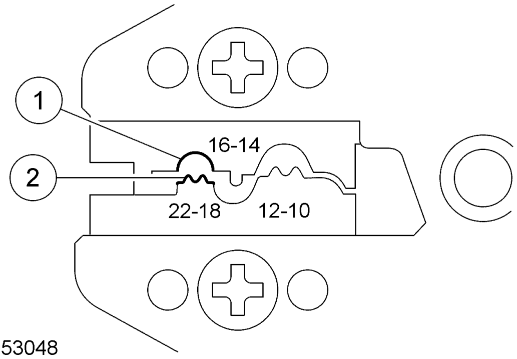
Section 2: Electrical



N0079052

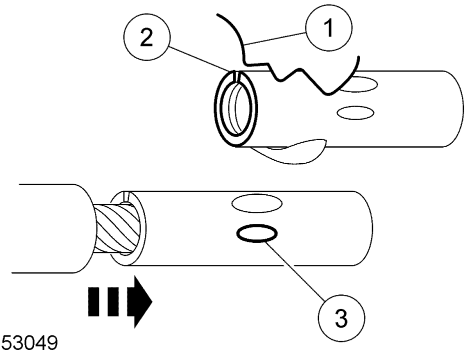
4. Select the appropriate wire splice for the wires to be spliced from Rotunda Wire Splice Kit 164-R5903.
5. **NOTE:**
   Rotunda 164-R5901 Pro-Crimper supplied with the wire splice kit is the only tool that can be used with these splices.

   Identify the appropriate chamber on the Rotunda Pro-Crimper by matching the wire size on the dies with the wire size stamped on the butt splice.
   (1) Cavity
   (2) Indenter



N0053048

6. Crimp the connector.
   (1) Center one end of the wire splice in the appropriate crimping chamber.
   (2) Insert stripped wire into the barrel.
   (3) Holding the wire in place, squeeze the tool handles until ratchet releases.

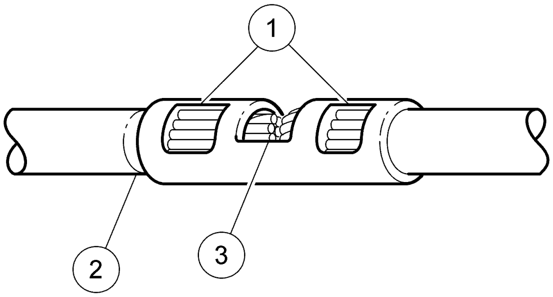


N0053049

7. Repeating Step 6, crimp the other half of the splice.
8. Check for acceptable crimp.

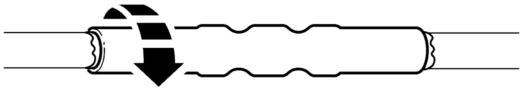
Section 2: Electrical

(1) Crimp should be centered on each end of the butt splice.
(2) Wire insulation does not enter butt splice.
(3) Wire is visible through inspection hole of splices.



N0053050

9. Evenly position supplied heat shrink tubing over wire repair.
10. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing.



N0070450

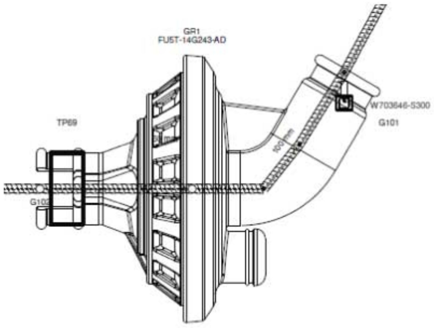
11. Reconnect the battery ground cable.

Electrical items for the F-150 Police Responder

- Location on dash panel to pass power through from the battery to police equipment in the cab/bed
- Park signal, pin number, wire color
- Brake signal, pin number, wire color
- Battery power access point and fuse rating, pin number, wire color
- Ignition power access point and fuse rating
- Vehicle speed output
- Driver door ajar signal
- Start fuse number/location (i.e Battery Junction box (BJB)), wire color
- Accessory delay fuse number/rating, location , wire color

Section 2: Electrical

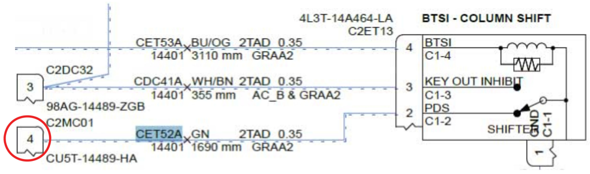
Dash Panel Pass Through From The Battery To Cab Interior


GR1
FU5T-14G243-AD
TP69
W703646-S300
G101
500 mm
G10

N0178417

- Located at the front passenger footwell is a grommet on the bulk head , this is the shortest path from the battery to inside the cab interior
- Currently there is no production designed access from the cab interior to the bed of the vehicle. A grommet or other means should be used.

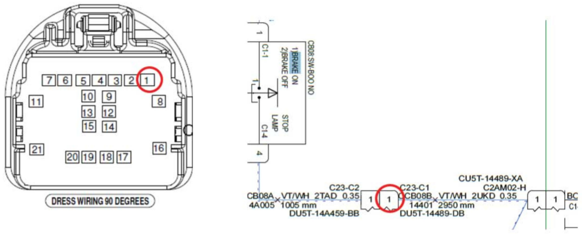
Park Signal (PDS – Park Detect Switch)


4L3T-14A464-LA
C2ET13
BTSI - COLUMN SHIFT
CET53A BU/OG 2TAD 0.35
14401 3110 mm GRAA2
C2DC32
3
CDC41A WH/BN 2TAD 0.35
14401 355 mm AC_B & GRAA2
98AG-14489-ZGB
C2MC01
4
CET52A GN 2TAD 0.35
14401 1690 mm GRAA2
CU5T-14489-HA
4
BTSI
C1-4
3
KEY OUT INHIBIT
C1-3
2
PDS
C1-2
SHIFTER
GND
C1-1
1

N0178418

- Pin 4 on the cluster connector
- Wire color is green (GN)
- Circuit from brake shift interlock in shifter to cluster
- Park signal is grounded when in park

Brake Signal


7 6 5 4 3 2 1
10 9
11
8
13 12
15 14
21
16
20 19 18 17
DRESS WIRING 90 DEGREES
1
C1-1
CB08:SW-BOO NO
1)BRAKE ON
2)BRAKE OFF
STOP
LAMP
C1-4
4
CB08A VT/WH 2TAD 0.35
4A005 1005 mm
DU5T-14A459-BB
C23-C2
1
1
C23-C1
CB08B VT/WH 2UKD 0.35
14401 2950 mm
DU5T-14489-DB
CU5T-14489-XA
C2AM02-H
1
1
BC
C1

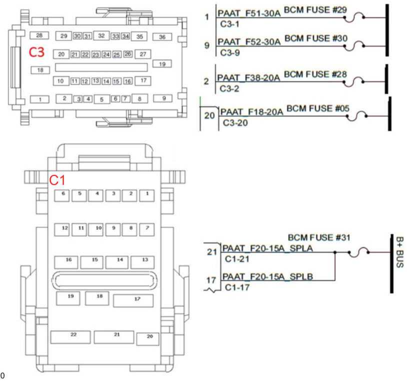
N0178417

- Pin 1 on 14404 (IP harness)/14A005 (body harness interconnect
- Located at driver side outboard footwell
- Wire color is violet/White (VT/WH)
- Circuit is closed 12 volts when brake is depressed

Battery Power Access Points

Battery (B+) power can be accessed at multiple points, but require adding terminals and circuits (terminal and wire information provided in the Body Control Module (BCM) information)

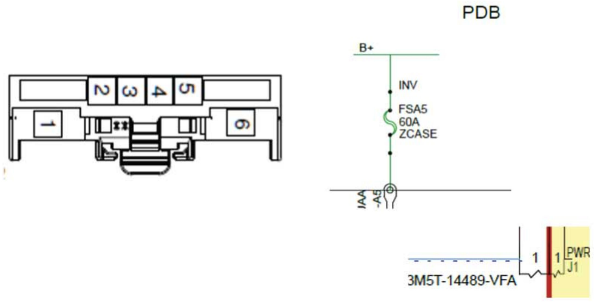
Section 2: Electrical


C3
1 PAAT_F51-30A C3-1 BCM FUSE #29
9 PAAT_F52-30A C3-9 BCM FUSE #30
2 PAAT_F38-20A C3-2 BCM FUSE #28
20 PAAT_F18-20A C3-20 BCM FUSE #05
C1
BCM FUSE #31
21 PAAT_F20-15A_SPLA C1-21
17 PAAT_F20-15A_SPLB C1-17
B+ BUS

N0178420

- BCM C3 Pin 1, fuse #29 rated at 30A
- BCM C3 Pin 2, fuse #28 rated at 20A
- BCM C3 Pin 9, fuse #30 rated at 30A
- BCM C3 Pin 20, fuse #05 rated at 20A
- BCM C1 Pin 17, fuse #31 rated at 15A

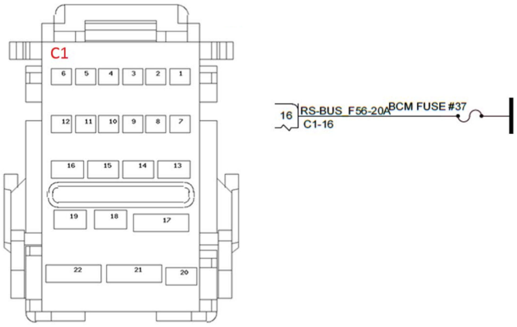
Battery (B+) power can be derived from the inverter power feed if vehicle is equipped with inverter and it is not needed. Inverter power connector is located at inverter under rear passenger side seat.


PDB
B+
INV
FSA5
60A
ZCASE
1
2
3
4
5
6
3M5T-14489-VFA
PWR
J1

N0178421

- At 6-way connector, Pin 1, wire color gray/red GY/RD
- Rated at 60A

Ignition Power (Run/Start) Signal

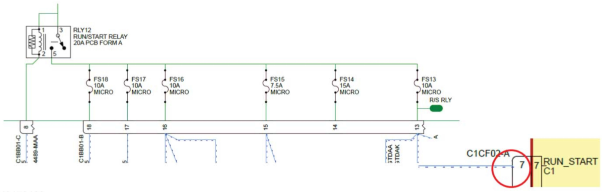

C1
16 RS-BUS_F56-20A C1-16
BCM FUSE #37

N0178422

- Run/Start signal is available via pin 16 of the 22 pin connector C1
- The circuit/terminal is not populated and will need to be added. Fuse 37 is rated at 20A

Section 2: Electrical

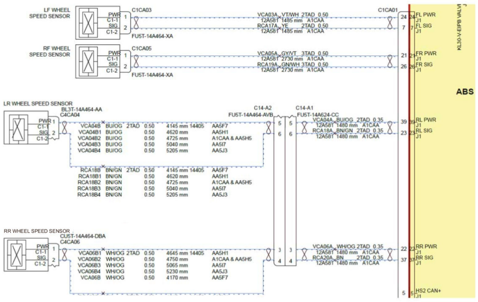
Ignition Power (Run/Start) Signal At 4X4 module


RLY12
RUN/START RELAY
20A PCB FORM A
FS18 10A MICRO
FS17 10A MICRO
FS16 10A MICRO
FS15 7.5A MICRO
FS14 15A MICRO
FS13 10A MICRO
R/S RLY
C1BB01-C
4489-MAA
C1BB01-B
C1CF02-A
7
RUN_START
C1

N0178423

- Run/Start signal is available at pin 7 of the 20 pin connector to the 4X4 module gray/brown (GY/BN) wire
- The Power Distribution Box Fuse 13 is rated at 10A but is shared with the 4X4 module
- The 4X4 module is located up near the bulk head in the front passenger foot-well

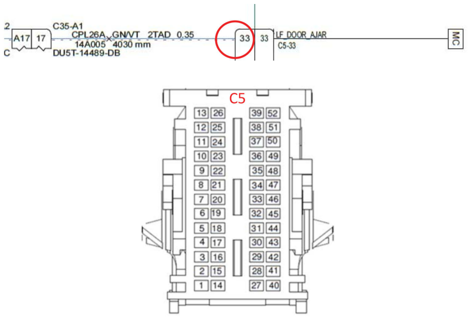
Vehicle Speed Output


LF WHEEL SPEED SENSOR
C1CA03
FU5T-14A464-XA
VCA03A VT/WH 2TAD 0.50
RCA17A YE 2TAD 0.50
C1CA01
FL PWR
FL SIG
RF WHEEL SPEED SENSOR
C1CA05
VCA05A GY/VT 3TAD 0.50
RCA19A GN/WH 3TAD 0.50
FR PWR
FR SIG
ABS
KL30-V-EIPB VALVE
LR WHEEL SPEED SENSOR
BL3T-14A464-AA
C4CA04
C14-A2
FU5T-14A464-AVB
C14-A1
FU5T-14A624-CC
VCA04A BU/OG 2TAD 0.35
RCA18A BN/GN 2TAD 0.35
RL PWR
RL SIG
RR WHEEL SPEED SENSOR
CU5T-14A464-DBA
C4CA06
VCA06A WH/OG 2TAD 0.35
RCA20A BN 2TAD 0.35
RR PWR
RR SIG
HS2 CAN+

N0178424

- Vehicle speed is recorded and sent to the Antilock Brake System (ABS) module for each wheel
- The vehicle speed reading wold be communicated via CAN messaging over the high speed 2 network or through the CAN message gateway
-

Driver Door Ajar

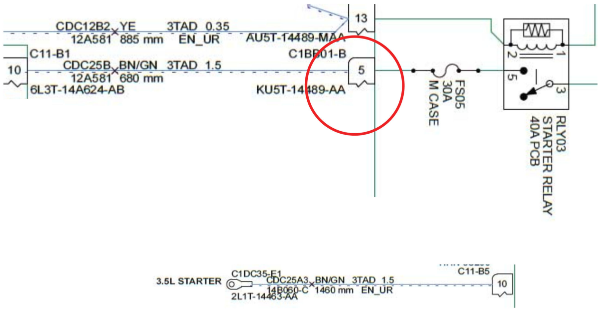

C35-A1
A17
17
CPL26A GN/VT 2TAD 0.35
14A005 4030 mm
DU5T-14489-DB
33
LF_DOOR_AJAR
C5-33
MC
C5

N0178425

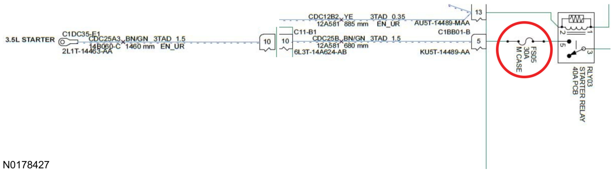
- Driver door ajar signal is available via pin 33 of the 52 pin connector C5 of the BCM (located at the outboard passenger foot-well)
- Wire is green/Violet GN/VT

Section 2: Electrical

Start Fuse


CDC12B2 YE 3TAD 0.35
12A581 885 mm EN_UR
AU5T-14489-MAA
13
C11-B1
10
CDC25B BN/GN 3TAD 1.5
12A581 680 mm
C1BB01-B
5
6L3T-14A624-AB
KU5T-14489-AA
FS05
30A
M CASE
RLY03
STARTER RELAY
40A PCB
3.5L STARTER
C1DC35-E1
CDC25A3 BN/GN 3TAD 1.5
14B060-C 1460 mm EN_UR
2L1T-14463-AA
C11-B5
10

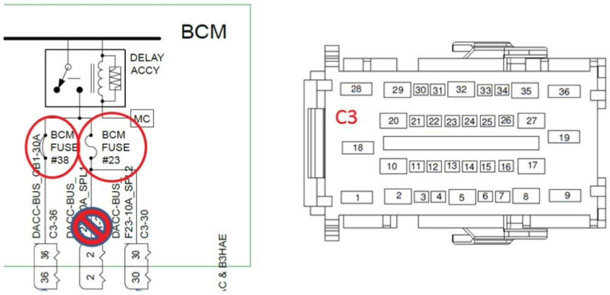
N0178426


3.5L STARTER
C1DC35-E1
CDC25A3 BN/GN 3TAD 1.5
14B060-C 1460 mm EN_UR
2L1T-14463-AA
10
CDC12B2 YE 3TAD 0.35
12A581 885 mm EN_UR
AU5T-14489-MAA
C11-B1
CDC25B BN/GN 3TAD 1.5
12A581 680 mm
6L3T-14A624-AB
C1BB01-B
KU5T-14489-AA
13
5
FS05
30A
M CASE
RLY03
STARTER RELAY
40A PCB

N0178427

- Start fuse (FS05, 30A M Case) located in PDB
- Pin 5 on large black PDB 50-pin connector
- Wire is a brown/green (BN/GN) from the PDB connector to starter eyelet

Delayed Accessory

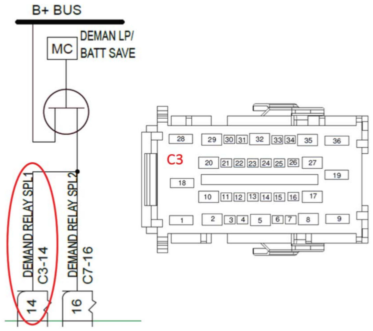

BCM
DELAY
ACCY
MC
BCM
FUSE
#38
BCM
FUSE
#23
DACC-BUS_CB1-30A
C3-36
DACC-BUS
DACC-BUS
F23-10A_SPL
C3-30
36
2
30
C3
28
29
30
31
32
33
34
35
36
20
21
22
23
24
25
26
27
18
19
10
11
12
13
14
15
16
17
1
2
3
4
5
6
7
8
9

N0178428

- Delayed accessory fuses located in BCM
- Fuse 38, 30A pin 36 on BCM C3 connector, wire color gray/blue (GY/BU) supplies power to window switches for all four doors
- Fuse 23, 10A pin 30 on BCM C3 connector brown/yellow BN/YE drives driver window switches sliding backglass, inverter and moonroof

Section 2: Electrical

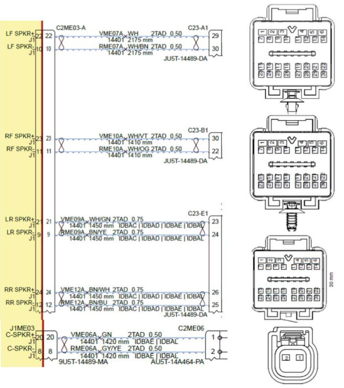
Battery Saver


B+ BUS
MC
DEMAN LP/
BATT SAVE
DEMAND RELAY SPL1
C3-14
DEMAND RELAY SPL2
C7-16
14
16
C3
28
29
30
31
32
33
34
35
36
20
21
22
23
24
25
26
27
19
18
10
11
12
13
14
15
16
17
1
2
3
4
5
6
7
8
9

N0178429

- Battery saver demand output FET
- Pin 14 on BCM C3 connector, wire color yellow/green (YE/GN); demands console and media ambient light, glovebox light and cab dome lights

Police Radio Speaker Outputs

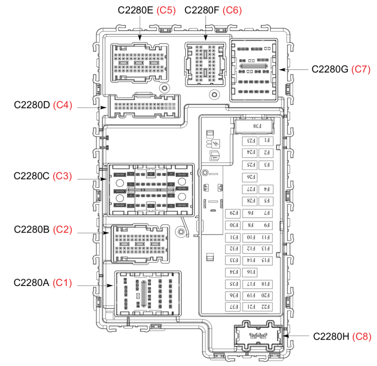

C2ME03-A
C23-A1
LF SPKR+
J1
22
LF SPKR-
J1
10
VME07A WH 2TAD 0.50
14401 2175 mm
RME07A WH/BN 2TAD 0.50
14401 2175 mm
29
30
JU5T-14489-DA
C23-B1
RF SPKR+
J1
23
RF SPKR-
J1
11
VME10A WH/VT 2TAD 0.50
14401 1410 mm
RME10A WH/OG 2TAD 0.50
14401 1410 mm
30
22
JU5T-14489-DA
C23-E1
LR SPKR+
J1
21
LR SPKR-
J1
9
VME09A WH/GN 2TAD 0.75
14401 1450 mm IDBAC | IDBAD | IDBAE | IDBAL
RME09A BN/YE 2TAD 0.75
14401 1450 mm IDBAC | IDBAD | IDBAE | IDBAL
23
24
RR SPKR+
J1
24
RR SPKR-
J1
12
VME12A BN/WH 2TAD 0.75
14401 1450 mm IDBAC | IDBAD | IDBAE | IDBAL
RME12A BN/BU 2TAD 0.75
14401 1450 mm IDBAC | IDBAD | IDBAE | IDBAL
26
25
JU5T-14489-DA
J1ME03
C2ME06
C-SPKR+
J1
20
C-SPKR-
J1
8
VME06A GN 2TAD 0.50
14401 1420 mm IDBAE | IDBAL
RME06A GY/YE 2TAD 0.50
14401 1420 mm IDBAE | IDBAL
1
2
9U5T-14489-MA
AU5T-14A464-PA
30 mm

N0178430

- Left Front speaker positive and negative circuits are available in the 30 pin connector located by the drivers outboard footwell at pins 29 and 30 wire color white/brown (WH/BN)
- Right Front speaker positive and negative circuits are available in the 30 pin connector located by the passengers outboard footwell at pins 30 and 22 wire color white/orange (WH/OG)
- Left Rear and Right Rear speakers positive and negative circuits are available in the 30 pin connector located under the middle front seat at pins 23/24 and 26/25 wire color white/green (WH/GN) brown yellow (BN/YE) brown/white (BN/WH) Brown Blue (BN/BU)
- Center speaker positive and negative circuits are available in the 2 pin connector located at the center speaker top of the instrument panel wire color green (GN) and gray/yellow (GY/YE)

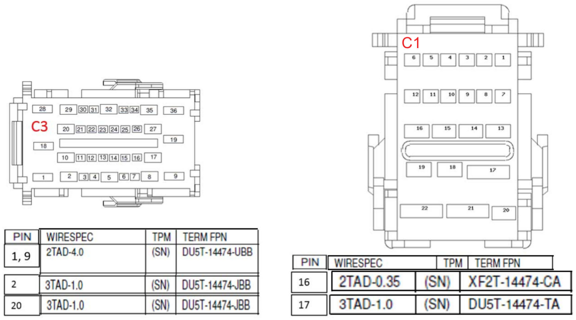
Section 2: Electrical

Body Control Module (BCM)



N0178416

Body Control Module Connector Terminal Information



PIN	WIRESPEC	TPM	TERM FPN
1, 9	2TAD-4.0	(SN)	DU5T-14474-UBB
2	3TAD-1.0	(SN)	DU5T-14474-JBB
20	3TAD-1.0	(SN)	DU5T-14474-JBB

PIN	WIRESPEC	TPM	TERM FPN
16	2TAD-0.35	(SN)	XF2T-14474-CA
17	3TAD-1.0	(SN)	DU5T-14474-TA

N0178431

How To Change Option Content

Courtesy Lamp Disable (Dark Mode)

Move the panel dimmer control to the full down position, past the detent, to prevent the interior lights from illuminating when the doors are opened.

Rear Power Window Disable

The rear power windows of the F-150 Police Responder can be disabled by disconnecting the rear window motor connectors. These connectors are located inside the door, behind the door trim panel and must be secured to prevent interference with the window mechanisms. While they are disabled, the master window control switch will not control the rear windows. Refer to F150 Wiring Diagrams Manual for additional power window wiring information.

Wiring Reference Information

Ordering Information

To obtain information about ordering complete copies of Ford or Lincoln/Mercury publications, call 1-800-782-4356.

Available publications include Workshop Manuals, Wiring Diagrams, PC/ED Manuals and Owner's Literature.

In addition, a publications order form can be obtained by writing to: Ford Publications, c/o Helm Inc., P.O. Box 07150, Detroit, MI 48207.

Table of Contents

Contents **PAGE**

Section 3: Installation Considerations 3-2
  Mobile Radio Installation Guidelines 3-2
  Push Bumpers 3-3
  Siren and Grille Lights 3-4
  Interior Equipment Mounting 3-4
  Partition Installation Guidelines 3-4
  Console Design and Installation 3-5
  Battery Saver 3-7

Section 3: Installation Considerations

Section 3: Installation Considerations

Mobile Radio Installation Guidelines

NOTICE:

This information has been prepared for use by persons installing 2-way radio equipment (transmitters and receivers) in vehicles. It has been prepared in accordance with current engineering principles and generally accepted practices, using the best information available at the time of publication. These guidelines are intended to supplement, but not to be used in place of detailed instructions for such installations which are the sole responsibility of the manufacturer of the land mobile radio. Since it is not possible to cover all possible installations of 2-way radio equipment, Ford Motor Company cannot be held responsible for incidental or consequential damages arising from the use of the information contained herein. Certain land mobile radios or the way in which they are installed may affect the vehicle operations such as the performance of the engine and driver information, entertainment and electrical charging systems. Expenses incurred to protect the vehicle systems from any adverse effect of any such installation are not the responsibility of Ford Motor Company.

General Information

Ford Motor Company vehicles are designed and tested for safe operation with correctly installed and used land mobile/amateur radio communication equipment with up to 100 watt transmitter power.

Special design considerations are incorporated into all Ford vehicle electronic systems to provide immunity to radio frequency signals. To maintain compatibility with vehicle electronic systems, mobile 2-way radio and telephone equipment must be installed correctly by trained personnel, observing these general guidelines:

- Power connections should be made directly to the battery and fused as close to the battery as possible. Avoid using cigar lighter or power point receptacles as power sources for radio communication equipment.
- Antennas for 2-way radios should be mounted on the roof or the rear area of the vehicle. Care should be used in mounting antennas with magnet bases, since magnets may affect the accuracy or operation of the compass on vehicles, if so equipped.
- The antenna cable should be high quality, fully shielded coaxial cable, and kept as short as practical. Avoid routing the antenna cable in parallel with vehicle wiring over long distances.
- Carefully match the antenna and cable to the radio to achieve a low Standing Wave Ratio (SWR) and to avoid radio frequency currents on the antenna cable shield.

Check installations for possible interference between the communications equipment and vehicle electronics. Mobile radio equipment with greater than 100 watts output may require special precautionary measures beyond those outlined in this document.

This Guide is a supplement to the radio manufacturer's installation instructions for installing communication equipment in Ford vehicles. Additional sources of information are listed on page 3-4.

Radio transmitters are regulated by the Federal Communications Commission (FCC) in the United States. Compliance with FCC regulations is the responsibility of the manufacturer and/or user of transmitter equipment and not Ford Motor Company.

Installation Guidelines

⚠ **WARNING:**

Do not mount any transceiver, microphones, speakers or any other item in the deployment path of the airbag system. Failure to follow these instructions may result in personal injury.

Transceiver Location

Select a transceiver location that provides a solid mounting point, does not interfere with the vehicle operator controls and provides adequate ventilation.

Before using screws to mount the transceiver equipment, be sure to check for vehicle wiring under the carpet or behind the instrument panel which could be pinched, cut or otherwise damaged.

Radio Wiring and Routing

Make transceiver power connections directly to the battery and appropriately fused as close to the battery as possible. A weatherproof fuse holder is recommended. Twist the positive and negative power leads together to enhance noise immunity.

Use caution when routing wires between the passenger and engine compartments to avoid chafing or pinching of wires. Use grommets over any exposed sharp edges and strain reliefs to keep wires in place. Seal all holes to prevent moisture intrusion.

Route and secure all underhood wiring away from mechanical hazards such as exhaust manifolds steering shaft, throttle linkage, and fans.

Section 3: Installation Considerations

Maintain as much distance as possible between mobile radio power leads and the vehicle's electronic modules and wiring. Avoid running power leads in parallel with vehicle wiring over long distances.

NOTE:
On some Ford vehicles the rear window contains the entertainment radio antennas (AM and FM). Avoid using the rear window to mount mobile radio antennas in these vehicles.

Antenna Location and Installation

Permanently installed antennas are preferable over magnetic, glass or body lip mounts for anything other than for low power or temporary installations. Most of these alternate antennas can reflect significant power back at the feedpoint; this reflected power could then radiate from the feedline inside the passenger compartment and be picked up by the vehicle wiring. However, a magnetic-mount antenna is a good tool for checking the proposed fixed antenna location for unwanted effects on the vehicle since antenna location is a major factor in these effects.

Glass-mounted antennas should be kept as high as possible in the center of the rear window or windshield. Some vehicles use glass that contains a thin metallic coating for defrosting or to control solar gain; glass mount antennas may NOT function correctly when mounted on this type of glass. (Ford Privacy Glass contains such a coating.) Also, refer to the antenna manufacturer's recommendations.

If a magnetic mount antenna is used, take care to locate the magnetic base in a location which avoids interference to the vehicle's compass mechanism, if so equipped. Also, some Ford vehicles use non-metallic body panels (decklids, etc.). If metallic backing panels are used, do not block the reception paths for factory installed antennas, such as Global Position Satellite (GPS) transceivers, if so equipped.

NOTE:
To maintain proper operation, periodically check the antenna installation for correct SWR and any signs of damage or deterioration.

Antenna Tuning: It is important the antenna be tuned correctly and reflected power be kept to less than 10% (VSWR less than 2:1).

Antenna Cable Routing

Always use a high-quality, 1-piece coaxial cable (at least 95% shield coverage). Connector quality and termination techniques are just as important. The ARRL handbook provides excellent guidelines for terminating coaxial cables.

Treat antenna cable in the same way as the control and power cables. Avoid sharp edges and pinches and keep the cable as short as possible. Also, avoid routing the antenna cable in parallel with vehicle wiring over long distances it is necessary to cross over wiring cross at right angles. In some cases, additional shielding between the antenna cable and the vehicle wiring may be helpful.

Additional Information

Troubleshooting

Should vehicle-radio interaction develop following installation, the source of the problem should be identified prior to further operation of the vehicle. Most interaction problems can be eliminated by following these installation guidelines.

Possible causes of vehicle-radio interaction include:

- Antenna location (move antenna to another position)
- Antenna feed line routing (locate as far as possible from vehicle electronics and wiring)
- Inadequate shielding or loose/corroded connectors associated with the antenna feed line
- Mismatched antenna or high SWR
- Power feeds not connected directly to the vehicle battery
- Power feed routing (locate as far as possible from vehicle electronics and wiring)

If any vehicle radio interaction problems exist after following these guidelines, contact the radio equipment manufacturer for additional assistance.

Additional Sources of Information

Radio Frequency Interference: How to Find It and Fix It ISBN: 0-87259-375-4, The American Radio Relay League, Inc. Newington, Connecticut 06111-1494, Phone 203-666-1541 / Fax 203-665-7531

Giving 2-Way Radio Its Voice (booklet) Champion Spark Plug Company, Automotive Technical Services Dept., P.O. Box 910, Toledo, Ohio 43661

Push Bumpers

Effect On Air Bag Deployment

Section 3: Installation Considerations

Different push bumper designs have different deformation characteristics in a crash situation that may or may not affect the deployment of air bags. Without the benefit of crash tests on vehicles equipped with push bumpers (there are a number of different styles available), it is the opinion of Ford Motor Company that installation of some push bumpers could affect the timing of the air bag deployment. Use of a push bumper that mounts solely to the vehicle's bumper should not have a significant effect upon air bag deployment.

Effect On Weight Distribution

The balance and weight distribution of a vehicle is carefully planned to achieve optimal stability and handling. Push bumpers can change this weight distribution by adding excessive weight to the front of the vehicle. There are many different styles of push bumpers available. Depending on the mounting and weight of the push bumper to be installed, it could have an adverse effect on the handling of a vehicle. Always verify the vehicle ride height after the adding a push bumper. For additional information, refer to Section 1: General Information in this guide. Adjust the ride height if the measurements are not within specifications.

Airflow

The engine cooling system on a vehicle relies on correct airflow through the radiator to keep the engine at its correct operating temperature. When adding a push bumper to a vehicle, make sure this airflow is not obstructed, especially when lights and sirens are mounted on the push bumper. Reduced airflow could put additional strain on the cooling system and shorten the operational life of related components. During the installation process, keep the placement of components away from the grille area of the vehicle.

Siren and Grille Lights

The engine cooling system relies on correct airflow through the radiator to keep the engine at its correct operating temperature. When adding sirens and grille lights to a vehicle, make sure this airflow is not obstructed. Reduced airflow could put additional strain on the cooling system and shorten the operational life of related components. During the installation process, keep the placement of components away from the grille area of the vehicle.

Interior Equipment Mounting

Mounting of equipment should be accomplished by attaching to sheet metal or other structural points that will maintain its integrity during an impact and/or useful life during police use.

⚠ **WARNING:**
Interior trim panels should not be used for mounting police equipment.

Partition Installation Guidelines

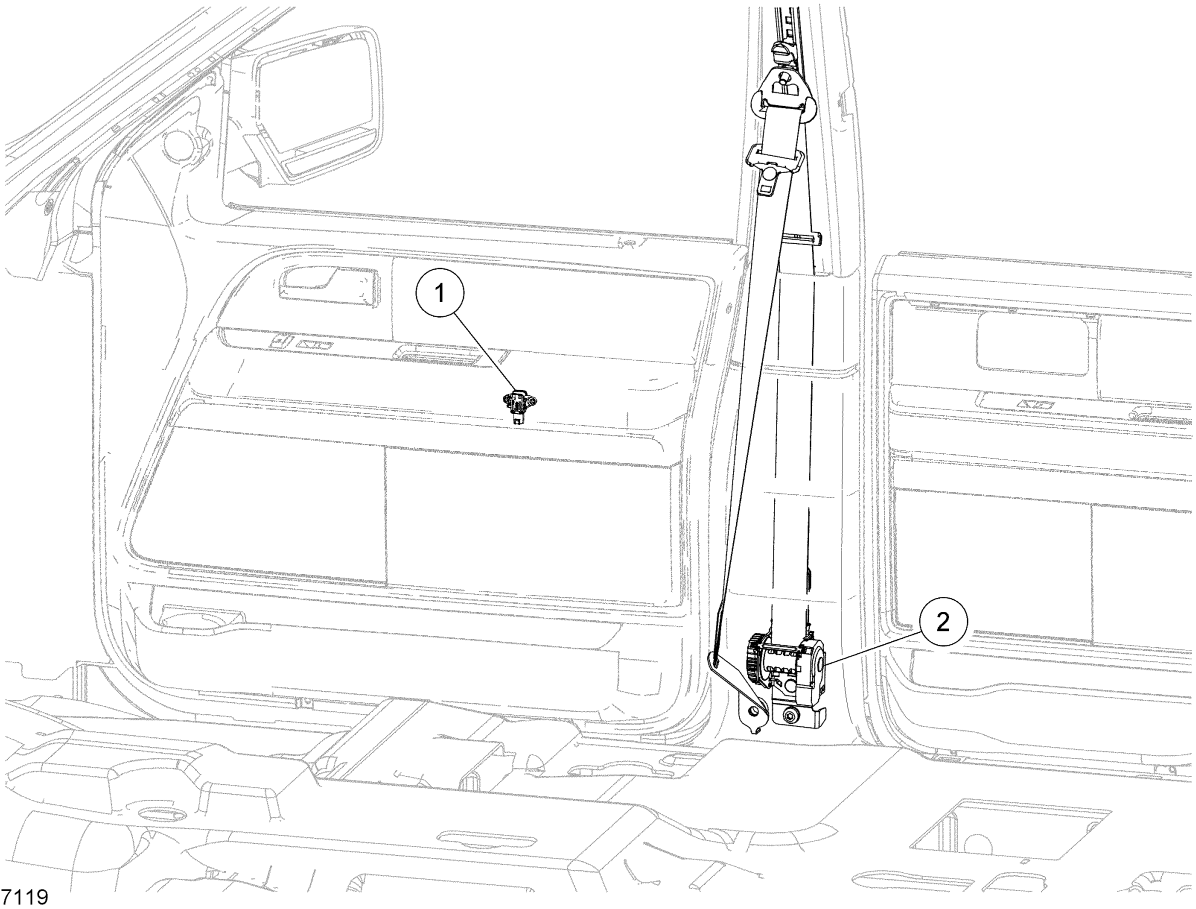
⚠ **WARNING:**
Side curtain deployment drawing are shown in Section 5: Reference Information. Review the deployment drawings before installing a partition or other equipment to make sure that there is no deployment interference. Failure to follow these instructions may result in personal injury.

⚠ **WARNING:**
The partition and the installation hardware of the partition must not interfere with the correct operation of the safety belt, safety belt retractor, side impact sensor and the safety belt height adjusters. Failure to follow these instructions may result in personal injury.

⚠ **WARNING:**
Installation of prisoner partitions may increase the risk of injury to front seat occupants if the vehicle is impacted from a high-speed rear-end collision. This risk should be balanced by the law enforcement agency against the risk of injury to the officer associated with prisoner transportation. Failure to follow these instructions may result in personal injury.

Safety Belt Retractor and Side Impact Sensor

Section 3: Installation Considerations



N0077119

Item	Description
1	Side impact sensor
2	Front safety belt retractor

The front safety belt retractors are located in the base of the B-pillars. The pretensioner located in the buckle is referred to as the safety belt buckle pretensioner. In the event of an air bag deployment, pretensioners provide improved occupant protection by rapidly removing slack from the safety belt. Removing slack from the safety belt helps to correctly position the occupant and allows for maximum effectiveness of the safety belts and the air bags.

- Do not use the safety belt retractor bolts for mounting the partition.
- Do not mount any partition hardware on the B-pillar.
- Do not mount any partition hardware that will interfere with the correct sealing of the door.

⚠ **WARNING:**

The front side impact sensors are located in the front doors. These are pressure sensors that measure the pressure change in the front door during an impact. Do not mount anything on or in the door. Do not cut any holes in the door sheet metal, trim or water seals. Failure to follow this instruction may cause personal injury.

Console Design and Installation

Restraints Control Module (RCM)

Section 3: Installation Considerations

⚠ **WARNING:**

Do not relocate the Restraints Control Module (RCM) or modify its installation in any way. Failure to follow these instructions may result in personal injury.

The RCM is mounted on the center tunnel under the carpet (under the first row bench seat if equipped). The RCM orientation is critical for correct operation of the restraint systems. Do not use the RCM mounting bolts as attachment points for equipment.

Air Bag Deployment Interference

⚠ **WARNING:**

Side curtain deployment drawing are shown in Section 5: Reference Information. Review the deployment drawings before installing a partition or other equipment to make sure that there is no deployment interference. Failure to follow these instructions may result in personal injury.

⚠ **WARNING:**

Do not place objects or mount equipment in front of the air bag module cover or in front seat areas that may come in contact with a deploying air bag. Dash, tunnel or console-mounted equipment should be placed within the specified zone. Dash, tunnel or console-mounted equipment should not be placed outside of the specified zone. Failure to follow these instructions may result in personal injury.

⚠ **WARNING:**

Do not mount equipment between the side of the front seat and the door trim that would block deployment of the side air bag. Failure to follow these instructions may result in personal injury.

Driver/passenger air bags affect the way police equipment can be mounted in police vehicles. Any surfaces that could come into contact with an air bag during deployment must not damage the air bag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon air bag material and reduce the effectiveness of the air bag. Do not mount or place any objects in the deployment path of an air bag. Air bags must be allowed to fully deploy without restriction. The deployment of air bags is not compatible with any configuration of police equipment mounting that places objects in the air bag deployment path. Equipment mounted or placed in the deployment area of an air bag will reduce the effectiveness of the air bag, damage the air bag and potentially damage or dislodge the equipment.

Air bag deployment drawings are provided in Section 5: Reference Information. Consult the drawings before equipment is installed inside the passenger compartment to make sure that the mounted equipment does not interfere with air bag deployment.

Seat Bolts

NOTICE:

Do not install longer seat bolts if reinstalling seats.

The vehicle safety belts and seat assemblies are factory installed in their correct location. Seat attaching bolts are not to be used as attachment points for any equipment. Any added material between the seat bolt and the seat frame could have unpredictable effects on the seat bolt torque. If the safety belts are removed for any reason, all of the appropriate attaching hardware must be hand started and then tightened to the correct torque specifications as per the workshop manual. Correct operation must be verified before returning the vehicle to service.

Driveshaft Clearance

When installing police equipment such as a console or other equipment in the console area, it is important to consider the available clearance between the underbody and the driveshaft. Never use self-tapping screws and never use screws that are longer than necessary in the console area.

Brake Line Clearance

When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.

Section 3: Installation Considerations

Battery Saver

NOTE:
Time-out is 10 seconds if the vehicle is in factory mode or 1 minute if the vehicle is in transport mode.

NOTE:
The battery saver does **not** control the parking lamps if the headlamp switch is in the PARKING LAMPS ON position

The BCM provides automatic shut-off of the courtesy and demand lamps after a time-out period when the ignition is OFF. A timer in the BCM starts when:

- the ignition transitions to OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of a remote keyless entry (RKE) transmitter is pressed.
- a door is unlocked using the passive entry feature.
- a valid code was entered on the keyless entry keypad.

When 10 minutes (30 minutes for demand lamps) have elapsed, the BCM automatically shuts off voltage to the lamps. The timer restarts (voltage is restored if the BCM is in battery saver mode) when:

- the ignition transitions out of OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of the RKE transmitter is pressed.
- a door is unlocked using the passive entry feature.
- a valid code was entered on the keyless entry keypad.

Table of Contents

Contents **PAGE**

Section 4: Cargo Mounting Considerations 4-2
  Cargo Area Equipment Mounting Guide 4-2
  Cargo Loading 4-2
  Cargo Area Weight 4-3

Section 4: Cargo Mounting Considerations

Section 4: Cargo Mounting Considerations

Cargo Area Equipment Mounting Guide

NOTICE:
When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.

NOTICE:
Inspect behind trim and under the vehicle when determining mounting locations. Be sure the drill/fasteners will not puncture/touch and will leave adequate clearance from the fuel tank, fuel lines, brake lines, wiring harnesses, evaporative emissions (EVAP) canister and the fuel pump shut-off switch as well as other vehicle systems. Refer to Section 5: Reference Information in this guide for additional illustrations showing the location of the fuel tank, fuel lines, brake lines and the fuel pump shut-off switch. Damage to vehicle components may occur.

Be aware of the following component locations when mounting equipment in the cargo area:

- Fuel tank
- Fuel lines
- Brake lines
- Evaporative emissions (EVAP) canister
- Electronic modules
- Wiring harnesses
- Spare tire

Cargo Loading

⚠ **WARNING:**
Ford recommends that police equipment be both secured and laterally aligned. Hard, stiff or sharp objects, especially when not secured or correctly located, pose a risk to the occupants. Aftermarket organizers that do not adequately deform in rear-impacts can themselves become injury-producing objects. Failure to follow these instructions may result in personal injury.

A acronym has been developed to increase police agency awareness of the importance of cargo packing. Improve police officer safety by implementing a cargo-packing process called "LOAD SAFE".

LOAD	SAFE
Lateral	**S**oft
Orientation	**A**nd
And	**F**ixed
Direction	**E**quipment

Equipment Categories and Placement

⚠ **WARNING:**
Gasoline should not be stored in the cargo area at any time, regardless of container. Failure to follow this instruction may result in personal injury.

It is recognized that a wide variety of equipment is carried in police vehicles as noted above. This section addresses the inherent risks of various types of equipment in the event of a high-speed rear impact.

- **Carrying Not Recommended —**The following items have been observed in police vehicles and **should not be transported in the vehicle cargo area**: containers with gasoline, loose ammunition, loose flares, loose fire extinguisher(s), loose 4-point lug wrenches, loose crowbars, loose axes and other loose equipment with potential injury capability in collisions.

Section 4: Cargo Mounting Considerations

- **Carry With Caution —**These items will require special packing or mounting consideration. Examples include (with proposed orientation): fire extinguisher (fixed), lug wrench 4-point (fixed, vertical), rolotape measuring wheel (fixed, vertical), safety flares (lateral orientation, in a container), stop stick (lateral), shovel (lateral, place at rear of cargo area), shotgun and rifle (lateral, store in case), baton (lateral, place at rear of cargo area), electronic equipment and ammunition (container). Flares should be placed in a protective storage container (preferably soft-sided plastic). Flares with spikes attached should be laterally oriented in the cargo area.
- **Low Risk Items —** These items are soft in feel and pose a low risk of potential injury capability in collisions. Examples are: a soft camera case, biohazard kit in plastic boxes, gloves, safety rope, tow strap, traffic cones and sleeves, rain gear, riot gear (soft), emergency blankets, bullet-resistant vests, tie straps, cloth tape, garment bags, first responder kit, Res-Q-Flo masks (placed in garment bag), fuses (plastic container), briefcases, notebooks, spray bottles, soft helmets and jumper cables.

Cargo Area Weight

The vehicle's high-speed handling and curb height becomes increasingly affected as weight is added to the cargo area. The more weight that is placed in the cargo area, the more it changes the ride and handling characteristics of the vehicle. Consider these factors when installing equipment and placing items in the cargo area of the vehicle.

Table of Contents

Contents **PAGE**

Section 5: Reference Information 5-2
  Engineering Drawings 5-2
  Exhaust System 5-8
  Roof Bow Highlighted For Light Bar Installation 5-8

Section 5: Reference Information

Section 5: Reference Information

Engineering Drawings

Air Bag Deployment Interference

⚠ **WARNING:**
Do not place objects or mount equipment in front of the air bag module cover or in front seat areas that may come in contact with a deploying air bag, dash, tunnel or console-mounted equipment should be placed within the specified zone. Failure to follow these instructions may result in personal injury.

⚠ **WARNING:**
Dash, tunnel or console-mounted equipment should not be placed outside of the specified zone. Failure to follow these instructions may result in personal injury.

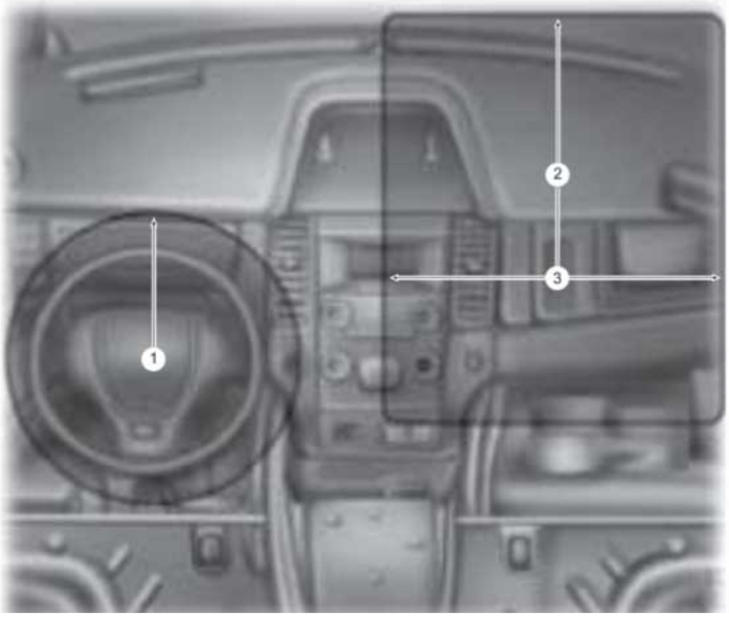
⚠ **WARNING:**
Do not mount equipment between the side of the front seat to the door trim that would block deployment of the side air bag. Failure to follow these instructions may result in personal injury.

Driver/passenger air bags affect the way equipment can be mounted in vehicles. Any surfaces that could come into contact with an air bag during deployment must not damage the air bag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon air bag material and reduce the effectiveness of the air bag. Do not mount or place any objects in the deployment path of an air bag. Air bags must be allowed to fully deploy without restriction. The deployment of air bags is not compatible with any configuration of police equipment mounting that places objects in the air bag deployment path. Equipment mounted or placed in the deployment area of an air bag will reduce the effectiveness of the air bag, damage the air bag and potentially damage or dislodge the equipment.

Some approximate dimensions for air bags, at full inflation, are provided in Figures 1 through 4. These dimensions are somewhat flexible and represent free-form deployments without the loading of occupants.

All airbag and equipment mounting zone dimensions are approximate due to different air bag deployment characteristics.

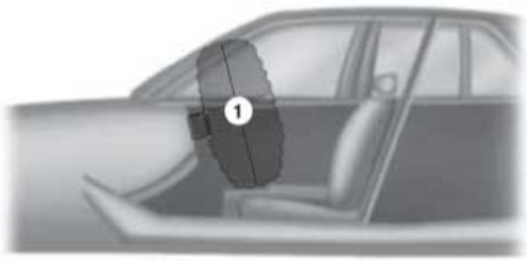
Mount no equipment between the side of the front seat and the door trim that would block deployment of the side air bag.



N0178432

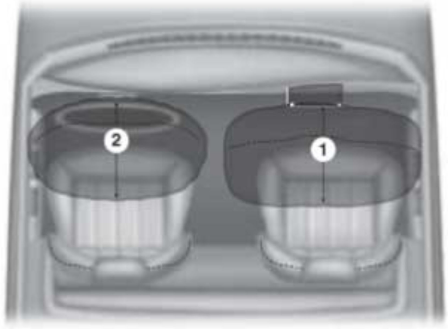
Section 5: Reference Information

Item	Description
1	From the center of steering wheel emblem. 14 inches (356 mm)
2	From the center of the passenger airbag door. 14.2 inches (361 mm)
3	No objects should be placed between the airbags due to airbag variability. 30.5 inches (775 mm)



N0178433

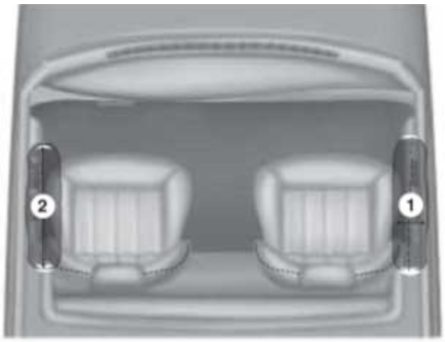
Item	**Description**
1	39.9 inches (1014 mm)



N0178434

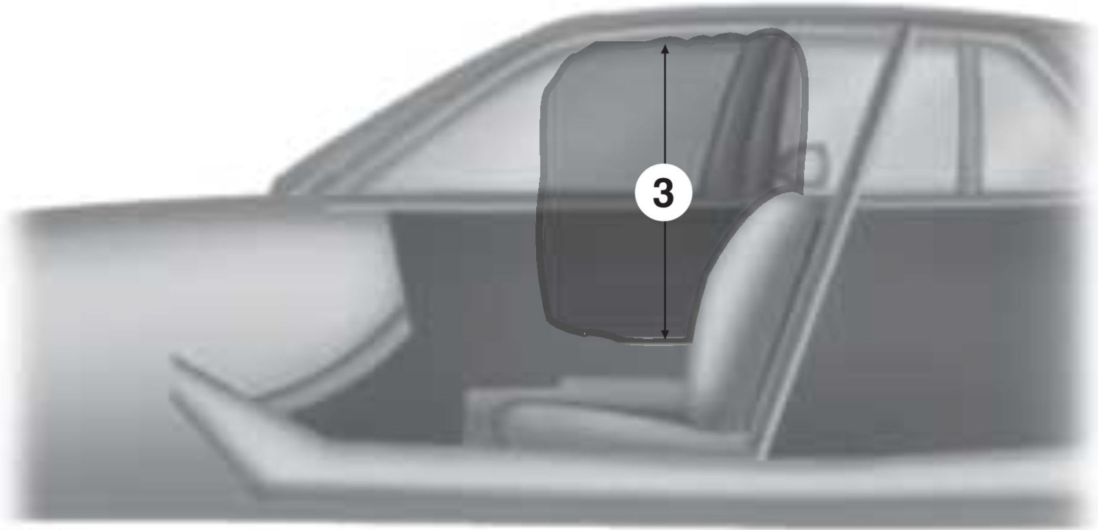
Item	**Description**
1	Front passenger airbag 37.5 inches (953 mm)
2	Front driver 18 inches (458 mm)

Section 5: Reference Information



N0178435

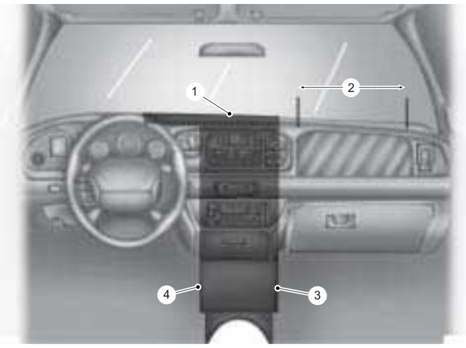
Item	Description
1	From the outboard side of seat 6.02 inches (153 mm)
2	Forward of seat back 14 inches (356 mm)



N0178436

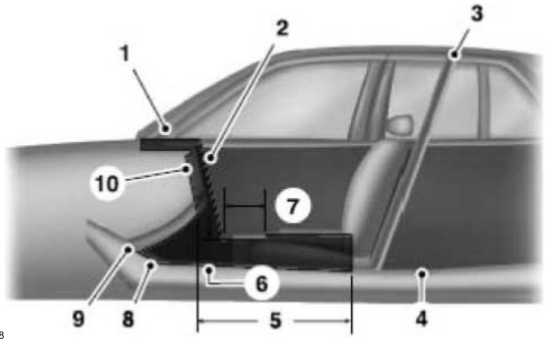
Item	Description
3	39.9 inches (1014 mm)

Section 5: Reference Information



N0178437

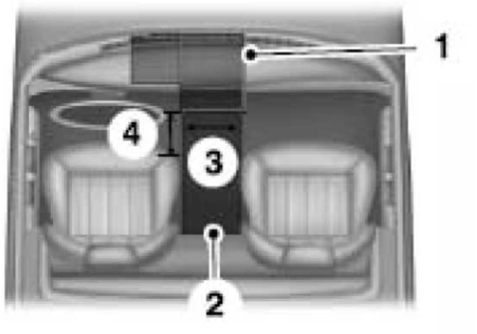
Item	Description
1	Area on top of instrument panel. Equipment must not interfere with the drivers visibility.
2	Airbag door must be kept clear for deployment of airbag.
3	Area in front of electronic finish panel from the bottom of the ashtray to the top of the instrument panel Passenger Side.
4	Area in front of electronic finish panel from the bottom of the ashtray to the top of the instrument panel Drivers Side.



N0178438

Item	Description
1	Area on top of instrument panel
2	Area in front of center console from tunnel to instrument panel
3	Prisoner screen
4	11 inches (279 mm)
5	Area on tunnel between seats
6	Height: 9.5 inches (241 mm)
7	13 inches (330 mm)
8	Area on tunnel beneath center console
9	Tunnel
10	Depth: 2.5 inches (64 mm)

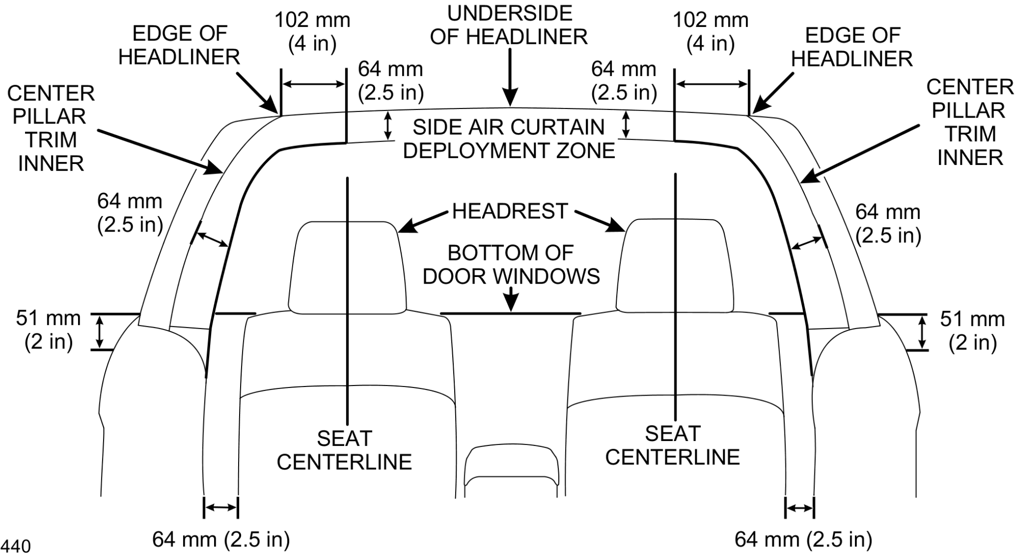
Section 5: Reference Information



N0178439

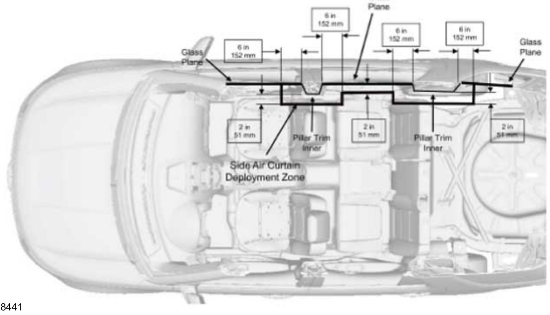
Item	Description
1	Area on top of instrument panel. Equipment must not interfere with driver visibility
2	Area on tunnel between seats
3	10 inches (305 mm)

CURTAIN AIRBAG DEPLOYMENT ZONE


EDGE OF HEADLINER
102 mm (4 in)
UNDERSIDE OF HEADLINER
102 mm (4 in)
EDGE OF HEADLINER
CENTER PILLAR TRIM INNER
64 mm (2.5 in)
64 mm (2.5 in)
CENTER PILLAR TRIM INNER
SIDE AIR CURTAIN DEPLOYMENT ZONE
64 mm (2.5 in)
HEADREST
64 mm (2.5 in)
BOTTOM OF DOOR WINDOWS
51 mm (2 in)
51 mm (2 in)
SEAT CENTERLINE
SEAT CENTERLINE
64 mm (2.5 in)
64 mm (2.5 in)

N0178440

Do not place any objects between the air bags due to air bag variability.


Glass Plane
6 in 152 mm
6 in 152 mm
Glass Plane
6 in 152 mm
6 in 152 mm
Glass Plane
2 in 51 mm
Pillar Trim Inner
2 in 51 mm
Pillar Trim Inner
2 in 51 mm
Side Air Curtain Deployment Zone

N0178441

Section 5: Reference Information

⚠ **WARNING:**
The front side impact sensors are located in the front doors. These are pressure sensors that measure the pressure change in the front door during an impact. Do not mount anything on or in the door. Do not cut any holes in the door sheet metal, trim or water seals. Failure to follow these instructions may result in personal injury.

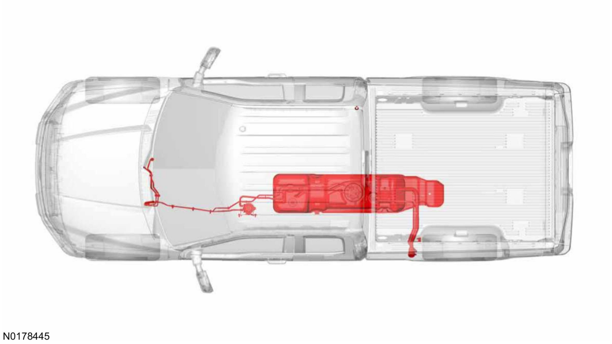
⚠ **WARNING:**
The rear side impact sensors are located in the C-pillars. The installation of hardware must not interfere with the correct operation of the rear side impact sensors. Failure to follow these instructions may result in personal injury.

The curtain airbag extends from the A-pillar to the C-pillar and from the roof rail to the beltline.

- Do not mount equipment to the B, and C-pillars above the beltline.
- Do not mount equipment to the A-pillar above the beltline except for spotlights.
- Do not mount equipment on the headliner within 200 mm (8 in) of the side edges.
- Do not mount equipment above the beltline within 200 mm (8 in) of the side glass from the A-pillar leading edge to the rear edge of the C-pillar.
- Do not mount equipment on the headliner along the saddleries.

Fuel System

Top View Silhouette of Fuel System components



Fuel Pump (FP) Shut-Off Feature

In the event of a moderate to severe collision, the vehicle is equipped with a FP shut-off feature that is initiated by the event notification signal.

The event notification signal is a signal provided by the Restraints Control Module (RCM) to the FP control module. Signal communication between the RCM and the FP control module allows the PCM to shut off the FP.

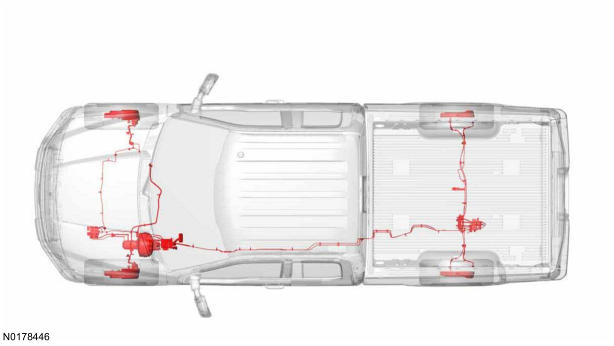
Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances the vehicle may not start the first time and may take one additional ignition cycle.

Brake System

Top View Silhouette of Brake System components

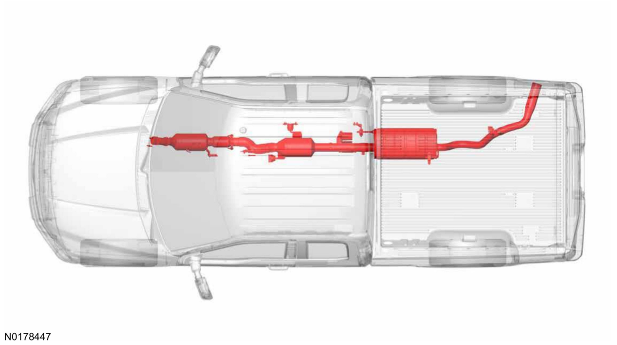
NOTICE:
When installing equipment, it is important to consider the available clearance between the brake lines and the fastener or component. Any fasteners or static components should allow a minimum of 15 mm (0.60 in) clearance to the brake lines. Any dynamic components should allow for a minimum of 19 mm (0.75 in) clearance to the brake lines.

Section 5: Reference Information

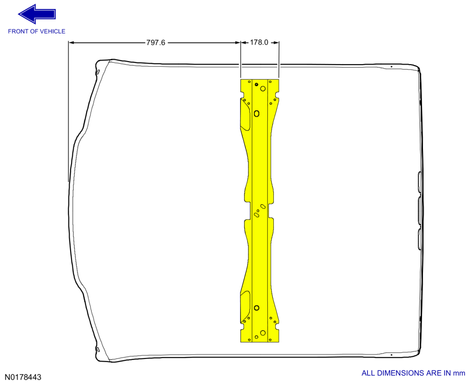


Exhaust System

Top View Silhouette of the Exhaust System components

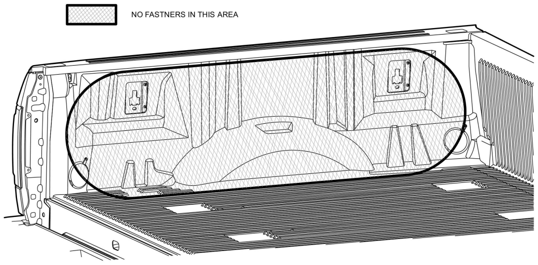


Roof Bow Highlighted For Light Bar Installation


FRONT OF VEHICLE
797.6
178.0
N0178443
ALL DIMENSIONS ARE IN mm

Section 5: Reference Information

Area In Bed To Avoid


NO FASTNERS IN THIS AREA

N0178444